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ABSTRACT

The Occupational Training Information System (OTIS), which is in operation in Oklahoma and in a developmental stage in Kentucky, was evaluated. The principle objective of OTIS is to provide the information necessary to formulate educational, manpower, and economic development plans and policies. OTIS consists primarily of a manpower demand subsystem, a manpower supply subsystem, and an interface subsystem. These areas were evaluated for their effectiveness in the two states. A resurvey was made to determine the accuracy of OTIS in predicting manpower demand. In Kentucky the forecasts for manpower demand and supply are inaccurate and the cost of the personal interview census is excessive; however, it is recommended that system development be continued if these problems are corrected. The favorable factors in Kentucky are the widespread support OTIS has and the type of information it provides. (WH)

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OTIS

EVALUATION OF THE OCCUPATIONAL TRAINING INFORMATION SYSTEM (OTIS)

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FINAL REPORT
EVALUATION OF THE OCCUPATIONAL TRAINING INFORMATION SYSTEM (OTIS)

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Economic Development Administration
U. S. Department of Commerce

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EXECUTIVE SUMMARY

The Occupational Training Information System (OTIS) first was developed in Oklahoma during 1968 to provide continuous, timely information for statewide vocational education planning and economic development. Subsequently, development of a more comprehensive version of the system was undertaken in Kentucky with Economic Development Administration (EDA) and state funds. MACRO SYSTEMS, INC. (MSI), was employed by EDA to evaluate this developmental effort. Since the Kentucky system was still under development, it also was decided to examine ongoing OTIS operations in Oklahoma. The purpose of this evaluation was to identify the strengths and weaknesses of OTIS and to recommend improvements where necessary. These findings and recommendations are summarized below.

I. FINDINGS

Although OTIS is comprised of several subsystems, the nucleus of the entire system is the interface of projected manpower demand with estimated manpower supply. Because of the criticality of the demand/supply interface, the evaluation focused on the demand, supply, and interface subsystems and on the overall system impact.

1. DEMAND SUBSYSTEM

Employer forecasts provide the basis for manpower demand projections in both Oklahoma and Kentucky. However, the procedures utilized by each state to collect these data differ markedly.

- Oklahoma collects baseline data from a sample of all state employers every four years. Only the largest employers are contacted personally; the remaining firms receive questionnaires in the mail and are contacted personally only if an adequate response for a particular cell is not received. The baseline data are updated annually to include new firms and significant employment changes for listed firms.

- Kentucky collects data through a personal interview census. During the initial year, only manufacturing employers were contacted.

MSI conducted a resurvey of a sample of the employers participating in the current OTIS surveys. The resurvey was conducted at the end of the forecast period in both Oklahoma and Kentucky so that forecast employment could be compared with current employment.

(1) Oklahoma Employer Forecasts

The forecast of manpower demand made by employers participating in the Oklahoma resurvey was underestimated by 1,342 positions. This understatement represents an error of 4 percent when related to total actual employment and 96 percent when related to the actual change in employment. An analysis of the forecasts made by individual firms indicated that:

- Over 60 percent of the employer forecasts did not increase the accuracy which would have been obtained with a simple no-change extrapolation.
- When compared to actual employment, nearly 30 percent of the firms made forecast errors of over 20 percent; the average error was over 26 percent.
- Over half of the employers had a forecast error equal to or greater than the actual change in employment. The average error was nearly 25 percent greater than the change in employment.

Additional analysis indicated that the type of forecast and employment size did not affect accuracy substantially.

(2) Oklahoma Regional Forecast

The previous analyses were concerned with the ability of an employer to forecast manpower demand. However, the data produced and utilized by OTIS are regional summaries of net manpower requirements by occupation and/or occupational cluster. Thus, the accuracy of the regional forecasts of manpower demand also was assessed. The results of these analyses indicated that:

- When compared to actual employment, the regional errors ranged from nearly 2 percent to over 17 percent. The average error for all regions was approximately 6 percent.
- When compared to change in employment, the regional errors ranged from over 8 percent to 67 percent. The average error for all regions was slightly over 50 percent.
- Combining the occupational data into vocational education clusters did not improve accuracy substantially.
- The forecast for "All Remaining Employees" did not affect the accuracy of the total forecast adversely.

(3) Kentucky Employer Forecast

The forecast of manpower demand made by employers participating in the Kentucky resurvey was overestimated by 1,100 positions. This overstatement represents an error of 2 percent when compared to actual employment and 98 percent when related to actual change in employment. An analysis of the individual forecasts indicated that:

- Over 75 percent of the employer forecasts did not increase the accuracy which would have been obtained with a simple no-change extrapolation.
- When compared to actual employment, over 29 percent of the employers made forecast errors of over 20 percent; the average error was over 30 percent.

- Over 50 percent of the firms made a forecast error equal to or greater than the actual change in employment. The average error was nearly 90 percent greater than the change in employment.

Additional analyses indicated that forecast accuracy was not affected by type of forecast or employment size.

(4) Kentucky Regional Forecast

An analysis of the regional aggregations of OTIS data indicated that:

- When compared to actual employment, the regional forecast errors ranged from less than 0.2 percent to a high of over 11 percent. The average error for all regions was 4.7 percent.
- When compared to actual change in employment, the forecast error ranged from a low of 2.4 percent to a high of over 300 percent. The average error for all regions was over 100 percent.

In addition, combining the occupational data into clusters did not significantly improve forecast accuracy.

2. SUPPLY SUBSYSTEM

In Oklahoma, supply totals are comprised primarily of graduates of formal training programs and registrants with the Oklahoma Employment Service Commission (OESC). Kentucky plans to obtain supply data from similar sources. With the exception of company-trained individuals, persons receiving formal vocational training appear to be adequately covered. However, individuals graduating from nonvocational schools or changing jobs are not included in supply. Quantifying the extent of these omissions is extremely difficult. However, the results of numerous studies indicate that the number of people available for jobs from nonvocational schools and other occupations is considerable.

Undoubtedly, some of the persons omitted currently from OTIS supply data are included in the OESC registrants, which comprise approximately 50 percent of manpower supply. However, despite the relatively high Employment Service penetration rates in Oklahoma, it is likely that many of these individuals are not included in the OESC totals. Thus, the published OTIS supply figures are understated.

3. INTERFACE SUBSYSTEM

The interface statistic is the principal output produced by OTIS. This statistic is computed by comparing estimated manpower supply for each occupation within a selected program cluster with projected manpower demand for the same occupations. As noted earlier, some of the OTIS forecasts of manpower demand are inaccurate and additional sources of manpower supply are required. However, even if manpower demand data were accurate and manpower supply data complete, the interface statistic must be used with caution for the following principal reasons:

- Manpower requirements data are aggregated statewide and by region. However, commutation patterns can affect the results. For example, an excess of supply for a particular occupation statewide or in a particular region may be offset by workers commuting to another state or region, e.g., nearly 36,000 more Kentucky residents commute to Ohio than Ohio residents commute to Kentucky.
- Net migration may alter the net manpower requirement projections over the course of the forecast period by decreasing or increasing manpower supply.
- Many trained individuals qualify for jobs outside the scope of their training, e.g., many workers have multiple skills and demonstrate a high degree of occupational mobility. Thus, supply for a particular occupation can change with personnel shifts.

4. SYSTEM IMPACT AND REPLICABILITY

The principal objective of OTIS is to provide the information necessary to formulate educational, manpower, and economic development plans and policies. Our analysis indicates that:

- OTIS output influences directly the Oklahoma state vocational education plan.
- Kentucky is incorporating OTIS data into the planning process.

The annual operating costs of OTIS Oklahoma are approximately $30,000, including approximately $19,000 for the demand subsystem. In Kentucky, OTIS annual operating costs are estimated to be $185,000, including over $110,000 for the demand subsystem. The relatively low annual operating cost in Oklahoma reflects the fact that benchmark demand data are collected through a sample of employers every four years. In addition, Kentucky utilizes personal interviews exclusively and Oklahoma contacts large employers personally and small employers by mail and telephone. In result:

- Oklahoma obtained data from employers at a field data collection cost of approximately $6 per employer.
- Kentucky obtained data from employers at a field data collection cost of approximately $28 per employer.

Thus, the total field cost of collecting demand data from a census of Kentucky employees is $1.2 million. Conversely, a 10 percent sample similar to that used in Oklahoma would cost from $29,000 to $120,000, depending on the extent of personal interviews. Therefore, the additional cost of conducting a personal interview census could be more than $1 million. Clearly, the cost of replicating the Kentucky OTIS demand data collection methodology is excessive, when compared to the cost of conducting a sample.

II. RECOMMENDATIONS

In general, OTIS Kentucky has widespread support and is providing the type of information required for manpower and vocational education planning. However, as noted above, some of the forecasts of manpower demand are inaccurate, manpower supply is understated, and the cost of a personal-interview census is excessive. Consequently, we recommend that system development be continued, if the following four improvements are incorporated to alleviate these deficiencies.

1. UTILIZE THE OCCUPATIONAL EMPLOYMENT STATISTICS SURVEY TO COLLECT CURRENT EMPLOYMENT DATA

The Occupational Employment Statistics (OES) survey program now being implemented in Kentucky should be utilized to collect current employment data. Although the OES program in Kentucky is not fully operational, in our judgment, this survey can meet the information needs of OTIS users, if the following refinements are made.

- Develop jointly a sampling procedure that will permit compilation of reliable, local-level data. The current employment data previously collected by OTIS should be useful in developing an appropriate sample.
- Conduct the entire OES survey annually for three years, rather than surveying manufacturing, nonmanufacturing, and trade employers in three-year cycles.

These survey data should be utilized immediately to develop regional industry-occupation matrices for Kentucky. Subsequently, these matrices can be utilized in the projection of manpower demand by occupation.

2. UTILIZE THE BUREAU OF LABOR STATISTICS (BLS) METHODOLOGY TO FORECAST MANPOWER DEMAND

The National/State Industry-Occupation Matrix System developed by BLS should be utilized to forecast employment. During the first year, the BLS census-based interim industry-occupation matrix for Kentucky can be utilized. Subsequently, the state regional matrices can be utilized with the National/State Matrix System to project manpower demand by occupation. In addition, the Employment Service should determine appropriate forecast periods in consultation with major data users; e.g., 3-, 5-, and 10-year projections with annual updates. Subsequently, the accuracy of these forecasts of manpower demand should be evaluated.

3. IMPROVE THE ESTIMATES OF MANPOWER SUPPLY

The OTIS estimates of manpower supply should be improved by:

- Adjusting the manpower supply figures to include informally training individuals, e.g., individuals from nonvocational schools or individuals who have become proficient through training or experience on the job.
- Identifying the extent of geographic mobility. Net migration in Kentucky is not significant; however, intra- and interstate commutation do involve a substantial proportion of the work force.

These improvements require additional research on occupational and geographic mobility.

Additional follow-up studies are necessary to obtain this information. In our judgment, these follow-up studies should be conducted two to five years after graduation and should include graduates from non-occupational training programs. The results of these studies will provide the data with which to assess the long-term impact of vocational training and to determine the occupational and geographic mobility of graduates from all types of schools in Kentucky.

4. EMPHASIZE THE QUALITATIVE ASPECTS OF VOCATIONAL EDUCATION TO INCREASE RAPPORT WITH EMPLOYERS

One of the important intangible benefits of OTIS is the rapport obtained with employers. In our judgment, the level of rapport can be increased by emphasizing the qualitative aspects of vocational education, rather than data collection. For example, under current procedures, rapport is sought by asking the employer for current and forecast employment by occupation and emphasizing the benefits of OTIS. This is done within the tight time constraints necessary to meet data collection requirements. Consequently, scheduling and conducting interviews are difficult for both vocational education personnel and employers.

Using the OES/BLS demand data collection and forecasting methodology, the industrial coordinators will receive the OTIS forecasts for their region. Subsequently, as part of their normal functions, the coordinators can discuss these occupational projections and related information with employers. More importantly, they can take the time to discuss the qualitative aspects of vocational education, e.g., the characteristics of a typical job and/or worker.

- Job characteristics include duties, working conditions, hours, wages, shifts, fringe benefits, and opportunities for advancement
- Employee characteristics include skills, attitudes, physical requirements, educational and training requirements, and work experience

In addition, current vacancies for placement purposes, potential technological changes, such as the introduction of new machines or products, and the employer's recent experience with vocational education graduates should be discussed. In our judgment, bringing a forecast to the employer, obtaining his ideas on its validity, and discussing how vocational education can meet his particular needs will result in a higher level of rapport than exists currently.

I. INTRODUCTION

The Occupational Training Information System (OTIS) was first developed in Oklahoma in 1968 to provide continuous, timely information for statewide vocational education planning and manpower development. Subsequently, the Bureau of Vocational Education of the Kentucky State Department of Education and the Economic Development Administration (EDA) of the U. S. Department of Commerce became interested in the system. Bureau personnel believed that the system would satisfy needs for new and more specific information to support planning efforts. EDA was interested because the additional information provided by OTIS and resultant planning improvements could (1) maximize the utilization of EDA-funded educational facilities and (2) provide the skilled craftsmen necessary to sustain economic growth. Consequently, development of OTIS in Kentucky was undertaken with state and EDA funds.[1/]

The original OTIS conceptual model was comprised of six interrelated subsystems. Subsequently, this model was considerably revised and a more comprehensive version formed the basis of the Kentucky model. In addition, the scope of the Kentucky model was broadened by the addition of several new subsystems to give greater emphasis to manpower planning. However, the original objectives of the system were not changed substantially.

Currently, OTIS in Kentucky is under development, and only four subsystems have been implemented. Further, only one subsystem, the demand component, is totally operational, but data have been collected and processed for manufacturing industries only. Bureau personnel in Kentucky want to

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[1/] In Kentucky, OTIS is known as the Kentucky Information for Training and Education System (KITES).

proceed with this developmental effort and several other states are also interested in installing similar systems, particularly if federal funding is available. Consequently, EDA requested an evaluation of OTIS prior to committing additional funds for system expansion or replication.

MACRO SYSTEMS, INC. (MSI), was employed by EDA to conduct an evaluation of the OTIS developmental effort in Kentucky and to examine ongoing OTIS operations in Oklahoma. The purpose of this evaluation is to ascertain the strengths and weaknesses of the system and to recommend improvements where necessary. Our evaluation focuses on OTIS Kentucky because the system concept is more comprehensive and the development partially funded with EDA monies. The results of this study are presented in the following chapters.

- Chapter II describes the background, concept, and current status of OTIS in Oklahoma and Kentucky.
- Chapter III describes current OTIS operations and costs and presents our findings regarding the operational effectiveness of the various subsystems and the overall impact of OTIS, including system replicability.
- Chapter IV presents our recommendations regarding system improvements and/or replication.

Relevant background material and detailed information supporting our analyses are included in the appendices.

II. BACKGROUND

OTIS was first implemented in Oklahoma. Since implementation, the system has been revised substantially. Currently, a more comprehensive version of OTIS is under development in Kentucky. This chapter presents our understanding of the conceptual and operating models implemented in each state.

1. THE OTIS CONCEPT WAS DEVELOPED BY OKLAHOMA IN 1968

The ultimate objective of vocational education, as specified in the 1968 amendments to the Vocational Education Act of 1963, is employment for program graduates. Equally important, trained individuals are necessary to sustain economic growth. Realization of these objectives requires accurate forecasts of manpower demand and supply. Accordingly, forecast requirements were the focus of two major studies completed in 1967 by Ling-Temco-Vought, Inc.,[1] and Oklahoma State University.[2] The results of these occupational studies indicated a need for an operational data system to provide continuous, timely information for statewide vocational education planning and manpower policy development in Oklahoma.

Subsequently, representatives from the Research Department of the Oklahoma Industrial Development and Park Department, the Oklahoma Department of Vocational and Technical Education, the Oklahoma Employment Security Commission (OESC), and the Manpower Research and Training Center at

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[1] Ling-Temco-Vought, Inc. (Prime Contractor), Systems Management Services, Vocational and Technical Skills and Literacy Systems. Report II: Washington, D. C.: Ozarks Regional Commission, December, 1967.

[2] Braden, Paul V. and Roney, Maurice W., Occupational Education Beyond the High School in Oklahoma: An analytical study with recommendations for a statewide system for manpower development. Stillwater, Oklahoma: The Research Foundation, Oklahoma State University, January, 1968.

Oklahoma State University met to study the need for a data system to provide information necessary to support the state's vocational training and economic development programs. In response, a proposal to develop a statewide manpower data system was prepared by the Manpower Research and Training Center. The results of the initial research emphasized the establishment of system parameters, including:

- Potential user population
- Information and user linkages
- Information input processes
- Report formats for data analysis and dissemination
- Information feedback and system modification procedures
- User involvement strategies to ensure system effectiveness

Based upon the specification of overall user requirements and other pertinent system parameters, data were collected and the first annual OTIS Cycle Report was published in January, 1969.[1]

The first report was necessarily incomplete due to the short time period between project approval and completion. However, this report did furnish the requisite operating experience to enable system development to be continued. As a result, a second Cycle Report contained significant refinements. Further, the success of the efforts over the two-year period led to the permanent designation of system operating responsibility. The State Department of Vocational and Technical Education was selected as the operating agency, based on the assumption that as the prime user of OTIS, this department would be the logical focus of operations to assure maximum effort and interest during implementation. Currently, this agency exercises full operating responsibility for OTIS within the context of agency planning and analysis functions. The major share of these operating activities is performed by the Research, Planning, and Evaluation Division. However, manpower demand data are collected and edited by the OESC.

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[1] The OTIS Final Report gives credit for the system concept to Dr. Pat Choate (then Director of Research) and Mr. George Appley of the Industrial Development and Park Department, and for system development, to Dr. Paul V. Braden of the Manpower Research and Training Center who served as Project Director. Dr. Braden was assisted by researchers Dr. Krishan Paul and James L. Harris. Braden, Paul V., et al, Occupational Training Information System (OTIS) Final Report, Research Foundation, Oklahoma State University, Stillwater, Oklahoma, 1970.

2. THE ORIGINAL OTIS CONCEPTUAL MODEL CONSISTED OF SIX INTERRELATED SUBSYSTEMS

OTIS was developed over a two-year period. Exhibit I, following this page, presents an early version of the OTIS model. The early model included only four subsystems: supply, demand, interface, and cost/benefit. Exhibit II, following Exhibit I, presents an overview of the OTIS model as it was designed for implementation in Oklahoma. This exhibit depicts the functional relationships among the six major conceptual subsystems described in the OTIS Final Report.[1]

The principal objectives of the original OTIS model were to provide, on local, regional (infrastate), and state bases, the planning and operating information necessary to:

- Permit the formulation of manpower planning strategies and assist in manpower decision-making
- Enhance the formulation of viable economic development policies and programs
- Establish needed vocational and technical training programs
- Enhance program graduate employment potential
- Facilitate development of programs for specific groups such as the handicapped
- Meet legislative and community accountability requirements

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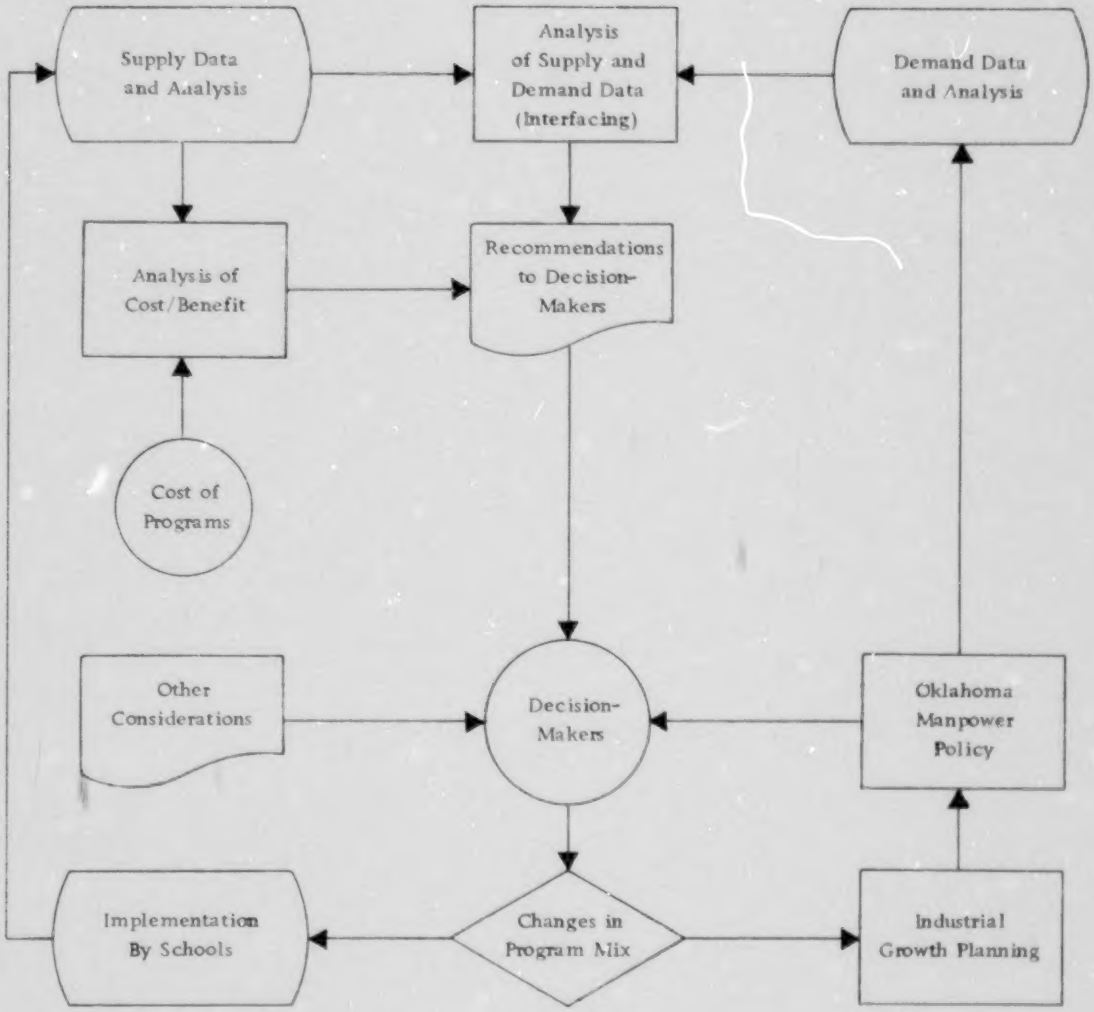
[1] A conceptual diagram was not included in the OTIS Final Report. Hence, this overview was developed by MSI, based on the description of the system contained in the report.

EXHIBIT I

Economic Development Administration

OVERVIEW OF EARLY OTIS MODEL

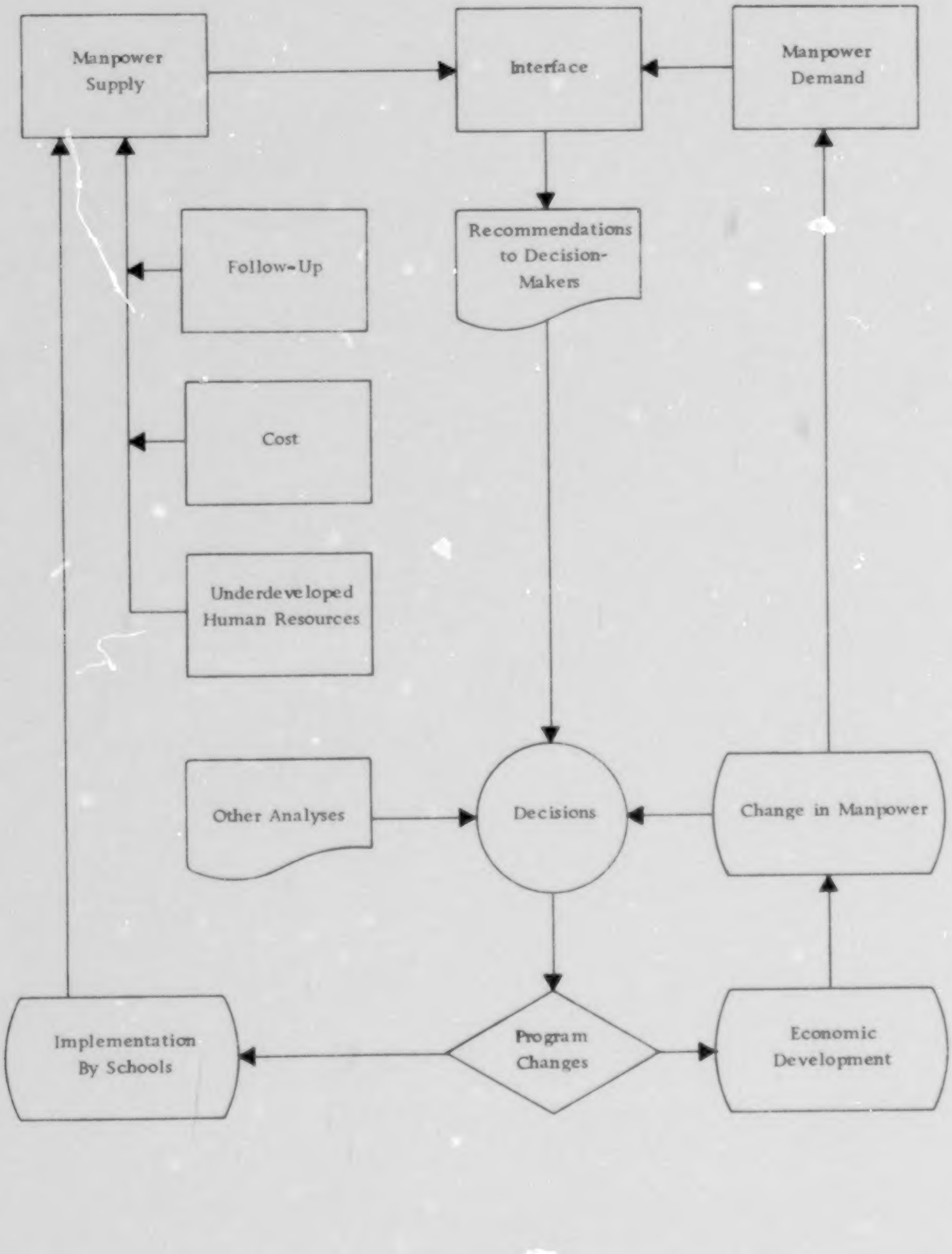

Supply Data and Analysis
Analysis of Supply and Demand Data (Interfacing)
Demand Data and Analysis
Analysis of Cost/Benefit
Recommendations to Decision-Makers
Cost of Programs
Other Considerations
Decision-Makers
Oklahoma Manpower Policy
Implementation By Schools
Changes in Program Mix
Industrial Growth Planning

Source: Paul, Krishan K. "An Assessment of The Oklahoma Private School Occupational Training Programs with Implications for Statewide Planning." Unpublished Masters Thesis. Oklahoma State University, May, 1970.

EXHIBIT II

Economic Development Administration

ORIGINAL OTIS CONCEPTUAL MODEL


Manpower Supply
Interface
Manpower Demand
Follow-Up
Recommendations to Decision-Makers
Cost
Underdeveloped Human Resources
Other Analyses
Decisions
Change in Manpower
Implementation By Schools
Program Changes
Economic Development

It was determined that these objectives could be met through the development of a model based on the collection, analysis, and comparison of manpower supply and demand data. In concept, the OTIS model functions as follows:

- Manpower demand data by occupation (DOT code) are collected from employers. These data represent the estimated number of jobs that will result from the expansion or reduction of manpower needs. Subsequently, these data are adjusted for replacement and summarized on regional and state levels.
- Manpower supply data are collected on planning areas and statewide bases. Manpower supply is defined as the total number of prospective employees receiving training in various vocational educational curriculum clusters or those certified by the employment service.
- Net additional manpower requirements are calculated by region for each cluster. The nucleus of the model is the comparison of the demand and supply figures for each cluster. The net result, either a demand or supply surplus, is summarized in a report called the OTIS Cycle Report. Exhibit III, following this page, presents a sample page from the Oklahoma report.

These net demand data are used with information from other subsystems to facilitate the formulation of vocational education policies. The entire manpower decision-making process takes place within an environment of socio-political involvement, i.e., policies are made within the context of community- and agency-wide participation. Thus, obtaining broad-based participation in both the formulation and implementation of plans and policies is fundamental to OTIS.

The six major subsystems comprising the initial OTIS model are described below.

(1) The Manpower Supply Subsystem Was Designed To Furnish Labor Market Entrant Information

The objective of the manpower supply component of OTIS is to provide information concerning the number of trained individuals entering the

EXHIBIT III

Economic Development Administration

SAMPLE PAGE CYCLE FIVE REPORT

Net Additional Manpower Requirements
1973

REGION [illegible]: OKLAHOMA CITY [illegible]

CLUSTERS OF OCCUPATIONS	DEMAND	SUPPLY							DEMAND MINUS SUPPLY	CLUSTERS OF PROGRAMS
		JESC REGIS-TRANTS	PUBLIC			FEDERAL		PRIV-ATE SCHOOLS		
			SECONDARY	POST SECONDARY	ADULT	MDTA	OTHER FEDERAL			
CLUSTER NO. 680										
625.281.0 DIESEL MECHANIC	121	13								
			24	26	1					171200 DIESEL MECHANICS
TOTAL	121	13	24	26	1				57	
CLUSTER NO. 690										
720.281.0 RADIO AND TV REPAIRMAN	21	4								
823.281.1 RADIO MECHANIC	12	5								
					6			3		171503 RADIO/TV
TOTAL	33	9			6			3	15	
CLUSTER NO. 700										
650.582.0 LINOTYPE OPERATOR	11	1								
651.782.0 CYLINDER-PRESS MA.	12	4								
651.782.1 OFFSET-PRESS MAN	39	5								
			1							171901 COMPOSITION, MAKEUP & TYPE-SET
			14	3	9					171902 PRINTING
TOTAL	62	10	15	3	9				25	

Source: Morton, J. B., Lyle, Edwina, Stevenson, William; OTIS Cycle Five Report 1973, Oklahoma State Department of Vocational and Technical Education, Stillwater, Oklahoma, January, 1973.

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labor market in any forecast year. In the initial model, most of these individuals were graduates from publicly funded vocational and technical education programs. A corollary objective of the supply component was to collect data necessary for a detailed evaluation of the vocational education curriculum. Thus, in addition to a numerical count of students enrolled in a variety of skill programs, the following data were collected:

- Student names and addresses for follow-up
- Student characteristics data
    - Economic status
    - Career goals
    - Ethnic and social background
    - Physical or mental handicap

These data, particularly student characteristics information, were to be collected jointly from students and teachers, and utilized in the preparation of a summary management report.

The student accounting system was selected as the primary mechanism for the collection of the supply data. However, other sources of supply data have been recognized and are included in the total supply data component. The additional sources of supply data and the student accounting system are discussed in detail later.

(2) The Manpower Demand Subsystem Was Designed To Furnish A Short-Term Forecast Of Labor Market Requirements

The OTIS demand component was conceived to yield a short-term forecast of manpower demand, where demand equals available new jobs plus estimated replacement positions. This component processes short-term employer estimates of manpower demand by occupation (DOT code) and aggregates these data on state and regional bases. In turn, these occupational demand forecasts are used to determine the net demand for specific vocational education training skills.

The principal objectives of the initial demand subsystem were to:

- Utilize the benchmark demand data for nonfarm wage and salary employment collected previously by the OESC
- Develop specific methodologies for collecting agricultural manpower demand data and generating acceptable agricultural forecasts
- Collect occupational manpower demand data to update the OESC benchmark data
- Develop a significant rapport between educators and representatives of industry

The initial demand data were collected by contacting personally all manufacturing employers in the state.[1] Most of the data collectors were occupational educators or industrial coordinators. This technique was selected to foster maximum personal contact and rapport between educators and the private sector to: (1) ensure employer participation; (2) assist in the development of the occupational forecast; and (3) enhance placement prospects for vocational/technical graduates.[2] The demand data procedures currently utilized in both states are described in Chapter III.

(3) The Interface Subsystem Computes Net Manpower Demand For Each Cluster Of Training Programs

The interface subsystem compares manpower supply and demand. Forecast demand and supply are listed for most occupations associated with selected training program clusters. Total manpower demand and total manpower supply figures for each cluster are computed by adding the figures for each occupation. Subsequently, the anticipated supply of trained personnel is subtracted from forecasted demand to obtain the net manpower requirement or surplus for each training cluster. Exhibit III, following page 6, presents the results of this process. The net requirements calculation is the nucleus of the OTIS model and provides requisite information for vocational education and manpower planning.

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[1] These data were utilized in the initial system development but were not included in the Cycle One Report.

[2] Braden, Paul V., *et al*, *Occupational Training Information System (OTIS) Final Report*, Research Foundation, Oklahoma State University, Stillwater, Oklahoma, 1970.

(4) The Initial Cost Data Subsystem Was Designed To Collect Information Concerning Costs Per Student

The cost data subsystem was designed initially to collect the information necessary to conduct program cost/benefit analyses. The results of these analyses were intended to provide the basis for resource allocation and a breakdown of the total expenditures for vocational education into specific program areas. The average cost per student is computed by dividing the costs for a specific program by the number of students enrolled in the program.

Although specific objectives for gathering detailed analytical program cost data are not presently defined, it is apparent that such data could provide significant input to decisions regarding curriculum mix. For example, cost information might indicate that a proposed program, which would benefit only a small group of students, requires inordinately large amounts of capital and personnel. Thus, a low-priority ranking could be accurately ascribed to the program.

(5) The Initial Graduate Follow-Up Subsystem Was Designed To Collect Postgraduate Job Placement Data For Program Evaluation

The graduate follow-up subsystem was conceived to collect information from program graduates. These data, in turn, were intended to assist curriculum planners in the development of a data base for evaluating program impact. Specifically, this subsystem was designed to produce three major evaluative reports.

- Mobility Pattern Report--This report was intended to present information concerning the locational changes of program graduates over time. Based on the comparison of training and employment site Zip Codes, a series of these reports would describe the movements of individual program graduates and discernible patterns for the group.

- Subsequent Employment Of Graduates Report--A major difficulty in assessing the impact of training involves determining the impact of specific training and skills upon the type of employment obtained by a program graduate. Accordingly, the objective of this report was to correlate and present training and employment data. The data collected in the follow-up subsystem were aimed at providing some indication of training/job linkages.

- Graduate Salary Study Report--A major issue in vocational education and manpower planning is the extent to which pre-employment skills training increases the entrance wage and long-term earning potential of an enrollee. Thus, training-related earnings increases represent a significant evaluative indicator of program effectiveness. Accordingly, the Graduate Salary Report was designed to display the salary levels of program graduates and identify salary differentials among graduates of different training programs.

Initially, the graduate follow-up subsystem was designed to collect data on 20,000 students annually through direct mailings. As many as three follow-up mailings per student were contemplated. At the same time, follow-up methods utilizing instructor contact with graduates were tested. After comparing both methods, the teacher follow-up method was selected as "faster and less costly." However, neither approach produced the anticipated results.[1] Consequently, the graduate follow-up subsystem has been incorporated into the student accounting system.

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[1] Research Coordinating Unit, Project Report #7, Oklahoma State Department of Vocational and Technical Education, Stillwater, Oklahoma, p. 11.

(6) The Initial Underdeveloped Human Resources Subsystem Was Designed To Identify Special Requirements Of Specific Labor Market Entrants

The purpose of the underdeveloped human resources subsystem was to identify specific population groups in need of special or supplementary services and training experiences. This target population is defined generally as unemployed, underemployed, and/or disadvantaged, and it includes culturally deprived as well as physically and mentally handicapped individuals.

Initially, attempts were made to collect general population profile data through a test survey in the Tulsa area. Approximately 285,000 questionnaires were distributed randomly in the street. However, only 5,045 usable responses were obtained. Subsequently, the idea of identifying the underdeveloped human resources in the general population was dropped and an alternative approach of collecting data on training program enrollees through the student accounting system was adopted.

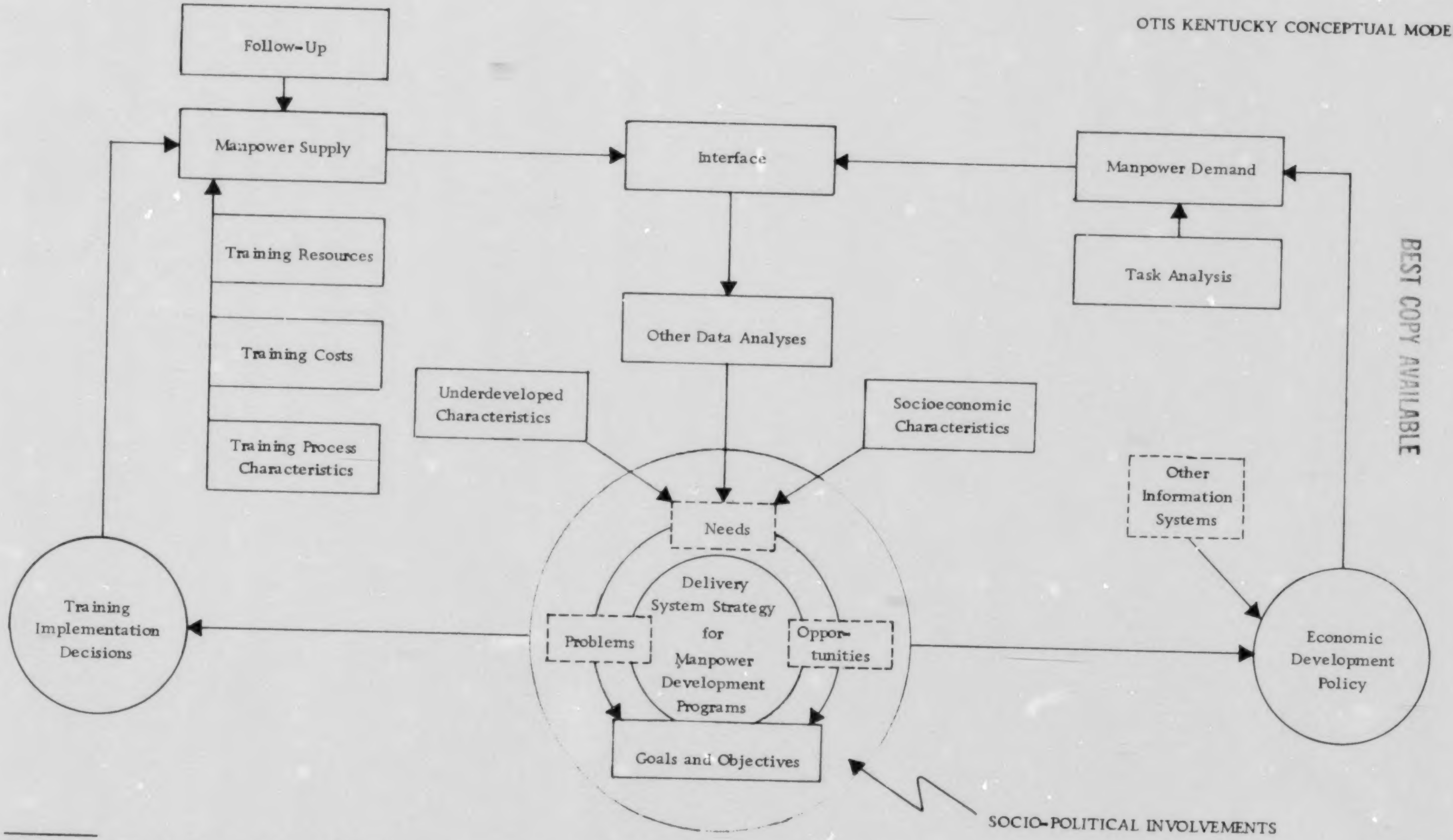
3. THE OTIS CONCEPTUAL MODEL HAS BEEN MODIFIED EXTENSIVELY FOR REPLICATION IN KENTUCKY

OTIS has evolved continually since its development began in Oklahoma in 1968. A more extensive version of the original OTIS model led directly to the formulation of the Kentucky OTIS model. The basic objectives of OTIS do not appear to have undergone substantial change in the Kentucky model. However, several subsystems have been modified and the addition of new subsystems has broadened the scope of the Kentucky model to include greater emphasis on manpower planning, of which vocational education is a significant part. Exhibit IV, following this page, displays the overall Kentucky OTIS model. The four additional subsystems developed for Kentucky are summarized in the following sections.

EXHIBIT IV

Economic Development Administration

OTIS KENTUCKY CONCEPTUAL MODEL


Follow-Up
Manpower Supply
Training Resources
Training Costs
Training Process Characteristics
Interface
Other Data Analyses
Manpower Demand
Task Analysis
Underdeveloped Characteristics
Socioeconomic Characteristics
Other Information Systems
Needs
Delivery System Strategy for Manpower Development Programs
Problems
Oppor-tunities
Goals and Objectives
Training Implementation Decisions
Economic Development Policy
SOCIO-POLITICAL INVOLVEMENTS

Source: Braden, P. B., An Overview of The OTIS (OTIS, Inc., May 1972), page 5; A Preliminary Technical Plan For The Adaptation And Installation Of The Occupational Training Information System (OTIS) In Kentucky (Initial Six Month Contract) And A Long-Range Strategy For Installation In Other Selected States Within The Southeastern Economic Development Administration (EDA) Region, Occupational Training Information Systems, Inc., Frankfort, Kentucky, April, 1972.

(1) The Goals And Objectives Subsystem Was Designed To Focus Attention On Key Human Resources Development Issues

The objective of the goals and objectives subsystem is to establish procedures for formulating "realistic goals and objectives for agencies which provide manpower-related services..."[1/] This subsystem was designed to link conceptually the manpower supply and demand components and public policy with the planning and decision-making processes. This approach to data organization has the potential to provide information for considering planning strategy, goals, and objectives. However, the actual definition of this component is not defined by available documents. Moreover, the focus of the goals and objectives subsystem described in the OTIS literature differs from that described by other researchers working on the Kentucky system.[2/] Exhibit IV, following page 11, presents the original Kentucky OTIS conceptual model. The revised model described by other researchers is included in Appendix A.

(2) The Educational Resources Subsystem Was Designed To Identify Human And Capital Resources For Allocation By Planning Decision-Makers

The educational resources subsystem represents an effort to develop capital and plant requirements data and personnel resources data for inclusion in the planning process. Shifts in educational policy, resulting from an examination of manpower supply and demand data and other labor market and economic condition indicators, have an impact upon the utilization of the total resources of the educational system. Thus, an inventory of these resources is necessary. This would enable

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[1/] Braden, Paul V., Proposal For Research And/Or Related Activities; Adaptation And Installation Of The Occupational Training Information System (OTIS) In Selected States And Districts Within The Southeastern EDA Region, Occupational Training Information Systems, Inc.: March 1972, p. 9.

[2/] Findlay, D. C., and Braden, P. V., An Overview Of The Comprehensive Data System For Occupational Education; (The Center for Research and Leadership Development in Vocational Education, The Ohio State University, unpublished paper--N. D.) pp. 3-5.

the planner to identify precisely the level of resources required to implement proposed educational changes. However, the development of this potentially important component has not progressed beyond the development of an inventory file.

(3) A Training Process Subsystem Was Formulated To Monitor Critical Training Variables For Program Upgrading

Exhibit IV, following page 11, shows training process characteristics as input information into the manpower supply component. Qualitative curriculum information would be useful to anticipate not only the types of skills being imparted to enrollees, but also how well these skills were were being taught. This component appears to call for the identification of specific training techniques or curriculum outputs in terms of their causal relationships with enrollee employment success. At a minimum, therefore, a variety of impact evaluation studies to test for significant curriculum variables would be required. It appears that some of this requisite employment experience data could be collected through the student follow-up subsystem. However, neither the operating linkages nor a generalized procedural approach have been formulated.

(4) The Delivery System Strategy Selection For Manpower Development Programs Subsystem Was Formulated To Establish Allocation Priorities

The delivery system strategy selection for manpower development programs subsystem was conceived to collect requisite system inputs and utilize these data to allocate resources. The objective of this component is to organize all data collected during the OTIS process and present a set of feasible operating strategies for review within the framework of the socio-political environment. Within this environment, the exact relationship among the elements of this subsystem, the goals and objectives subsystem, and a variety of other data or information inputs is not clear. Elements such as needs, opportunities, and problems appear to constitute the cognitive input of planners developed from the information collected by the OTIS subsystems. These data contribute to the formulation of policy-level goals and objectives and, thus, to the development of the delivery system strategy.

4. THE OTIS CONCEPT HAS NOT BEEN TOTALLY IMPLEMENTED

Extensive interviews with personnel in Oklahoma and Kentucky have indicated that neither OTIS conceptual model has been implemented fully. Exhibit V, following this page, presents the current status of development of the subsystems comprising the original conceptual model in each state. As indicated, the subsystems implemented in Oklahoma are:

- Manpower Demand Subsystem
- Manpower Supply Subsystem
- Interface Subsystem

In addition, the follow-up subsystem has been implemented by and incorporated into the state's student accounting system; underdeveloped human resources data are collected by the student accounting system; and an extremely limited version of the cost subsystem was developed as part of OTIS. Subsequently, the OTIS cost subsystem was dropped and a completely new cost system developed and implemented as part of the Oklahoma Department of Vocational Education Management Information System.

On the other hand, in the OTIS Kentucky model, only the demand subsystem of the 10 subsystems comprising the model is implemented. However, four other systems are under development.

- The manpower supply subsystem is being developed by state personnel.
- The interface subsystem is being developed and programmed in conjunction with EDA personnel.

EXHIBIT V

Economic Development Administration

CURRENT STATUS OF OTIS IN OKLAHOMA AND KENTUCKY

	OTIS Oklahoma Subsystem					
	1	2	3	4	5	6
Conceptual Model	Manpower Demand	Manpower Supply	Interface	Follow-Up	Cost Data	Under-developed Human Resources
Operating Model	Implemented	Implemented	Implemented	Incorporated In Student Accounting System	Replaced With Another System	Incorporated In Student Accounting System

	OTIS Kentucky Subsystem									
	1	2	3	4	5	6	7	8	9	10
Conceptual Model	Manpower Demand	Manpower Supply	Interface	Follow-Up	Cost Data	Under-developed Human Resources	Goals And Objectives	Educational Resources	Training Process	Resource Allocation Strategy
Operating Model	Implemented	Under Development	Under Development	Under Development	Not Yet Implemented	Not Yet Implemented	Not Yet Implemented	Inventory File Started	Not Yet Implemented	Not Yet Implemented

- The follow-up subsystem is being developed by the Center for Vocational and Technical Education at Ohio State University.
- An inventory file of educational resources has been started.

* * * *

This chapter has presented a discussion of the conceptual OTIS models and has described the current status of the systems actually implemented in Oklahoma and Kentucky. The next chapter describes current system operations and presents the findings resulting from our analysis of OTIS operations and utilization.

III. CURRENT OPERATIONS AND FINDINGS

The purpose of this study is to evaluate OTIS Kentucky and to examine ongoing OTIS operations in Oklahoma. Therefore, questions concerning the accuracy, operational effectiveness, and overall impact of OTIS must be answered. The operational effectiveness of the system can be determined by responses to questions about the individual subsystems. Specific questions relevant to each subsystem are:

- Demand Subsystem--Are the data collection procedures efficient? Are the data processed effectively? Are the forecasts of manpower demand complete and accurate? Do the data sources and collection procedures used by OTIS complement or duplicate Department of Labor (DOL) sources and procedures? Does OTIS data bank duplicate existing DOL data?

- Supply Subsystem--Are all sources of manpower included? Are data processed efficiently? Are forecasts accurate and complete?

- Interface Subsystem--Are the interface procedures efficient? Are net manpower requirements presented and utilized properly? Are interface tables timely and error free?

- Follow-Up Subsystem--Does training influence placement or career patterns? Does feedback data result in system changes?

- Underdeveloped Human Resources Subsystem--Are underdeveloped human resources identified? Are supplemental training and assistance provided?

- Cost Subsystem--Are the cost data useful for resource allocation?

- Goals And Objectives Subsystem--Are realistic goals and objectives established and performance monitored?

- Educational Resources Subsystem--Is an inventory of plants and equipment compiled and used for resource allocation?
- Training Process Subsystem--Are the outputs of other subsystems utilized to develop operating strategies?

Questions concerning the overall system and system impact include:

- Does OTIS provide the information needed for vocational and technical education planning?
- Are system outputs utilized to adjust the program mix and/or to maximize the utilization of educational resources?
- Does the reallocation of resources enhance the placement of vocational and technical graduates?
- Does OTIS provide the information needed for manpower planning and/or formulation of economic development strategies?
- Can OTIS be exported or replicated easily and inexpensively?

Clearly, many of these questions are interrelated. More importantly, several of the OTIS subsystems are not operational so that some of the questions cannot be answered. The demand/supply interface is the nucleus of OTIS. Because of these limiting conditions and the criticality of the demand/supply interface, our evaluation focuses on the demand and supply subsystems and on the overall impact of the system. The results of our analyses of OTIS in Oklahome and Kentucky are presented subsequently. Findings about the subsystems are presented first, followed by our analysis of the total system and its impact.

MANPOWER DEMAND SUBSYSTEM

This section describes the demand data collection procedures utilized in Oklahoma and Kentucky and presents our findings regarding the manpower demand component. Specifically, the following aspects of the demand subsystem are discussed:

- The similarities and differences between the demand data collection methodologies currently utilized in Oklahoma and Kentucky
- The accuracy of the employer forecasts of manpower demand
- The relative accuracy of forecast demand by type of forecast, size of firm, and industry
- The accuracy of the occupational forecasts by region
- The effect of clustering on the accuracy of the occupational forecast
- The problems encountered in collecting the demand data in Kentucky
- The comprehensiveness of the manpower demand data utilized by OTIS

1. OKLAHOMA AND KENTUCKY UTILIZE DIFFERENT PROCEDURES TO COLLECT MANPOWER DEMAND DATA

Employer forecasts provide the basis for projecting demand in both Oklahoma and Kentucky. However, the procedures utilized by each state to collect these data differ markedly.

- Oklahoma collects data from a sample of state employers.
- Kentucky collects data from a census of employers of a particular type, e.g., all manufacturing employers.

Exhibit VI, following this page, illustrates the manpower demand data collection process for each state. Further, Exhibit VII, following Exhibit VI, compares the attributes of the Oklahoma and Kentucky survey methodologies.

In both states, the demand data collection activity depends upon personal contacts between employers and trained representatives of the OESC or the Kentucky State Department of Vocational Education and other state agencies. Personal contacts are emphasized to attempt to assure that employers produce

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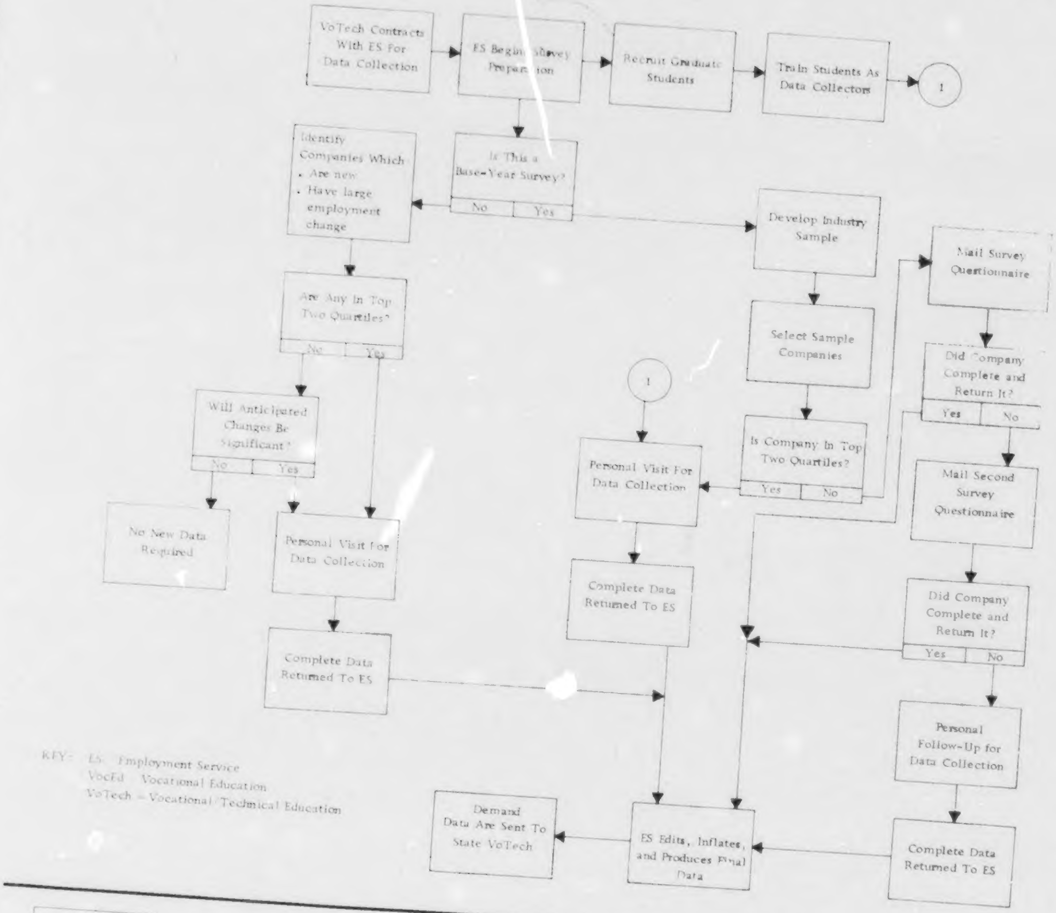
EXHIBIT VI

Economic Development Administration

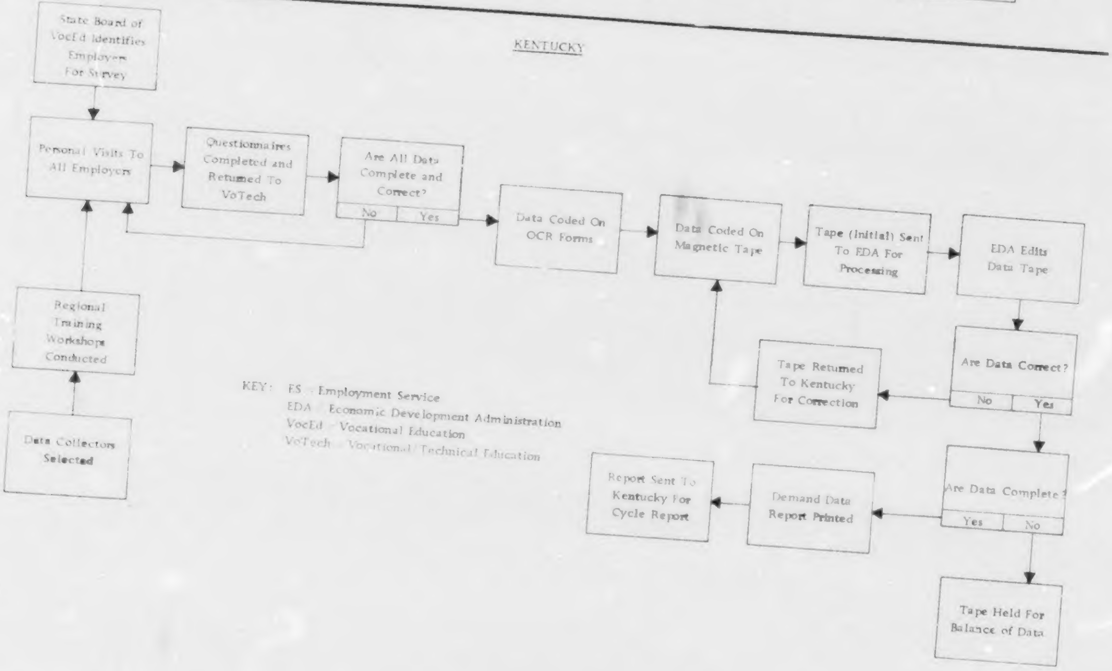
OTIS DEMAND DATA COLLECTION
PROCEDURES

OKLAHOMA



VoTech Contracts With ES For Data Collection
ES Begins Survey Preparation
Recruit Graduate Students
Train Students As Data Collectors
1
Is This a Base-Year Survey?
No
Yes
Identify Companies Which:
. Are new
. Have large employment change
Develop Industry Sample
Mail Survey Questionnaire
Are Any In Top Two Quartiles?
No
Yes
Select Sample Companies
Did Company Complete and Return It?
Yes
No
1
Will Anticipated Changes Be Significant?
No
Yes
Personal Visit For Data Collection
Is Company In Top Two Quartiles?
Yes
No
Mail Second Survey Questionnaire
No New Data Required
Personal Visit For Data Collection
Complete Data Returned To ES
Did Company Complete and Return It?
Yes
No
Complete Data Returned To ES
Personal Follow-Up for Data Collection
KEY: ES Employment Service
VocEd Vocational Education
VoTech = Vocational/Technical Education
Demand Data Are Sent To State VoTech
ES Edits, Inflates, and Produces Final Data
Complete Data Returned To ES

KENTUCKY



State Board of VocEd Identifies Employers For Survey
Personal Visits To All Employers
Questionnaires Completed and Returned To VoTech
Are All Data Complete and Correct?
No
Yes
Data Coded On OCR Forms
Data Coded On Magnetic Tape
Tape (Initial) Sent To EDA For Processing
EDA Edits Data Tape
Regional Training Workshops Conducted
Tape Returned To Kentucky For Correction
Are Data Correct?
No
Yes
KEY: ES Employment Service
EDA Economic Development Administration
VocEd Vocational Education
VoTech Vocational/Technical Education
Data Collectors Selected
Report Sent To Kentucky For Cycle Report
Demand Data Report Printed
Are Data Complete?
Yes
No
Tape Held For Balance of Data

EXHIBIT VII

Economic Development Administration

OKLAHOMA AND KENTUCKY DEMAND SURVEY ATTRIBUTES

	Attribute	Oklahoma	Kentucky
1.	Survey Period (Baseline)	Memorial Day, 1971 - Labor Day, 1971	June, 1972--No end date established
2.	Data Submission Cut-Off Date	September 15, 1971	No cut-off date established; data outstanding on February 28, 1973
3.	Forecast Target Date	June, 1971	May, 1972
4.	Target Employers	All business and government excluding the self-employed	Manufacturing
5.	Employer Identification Technique	Employment Security records maintained by OESC	Directory of Manufacturers, published by Kentucky Department of Commerce, and Employment Service data
6.	Stratification Technique for Sample	Separate by major industry division; arrange business by region and employment size; determine quartile separation; select sample	Stratification not required; census survey
7.	Sample Ratio Selection By Quartile:		
	. First	100 percent	100 percent
	. Second	100 percent	100 percent
	. Third	20 percent	100 percent
	. Fourth	5 percent	100 percent
8.	Survey Data Collection Instruments	Special schedules prepared by OESC	Schedules prepared by BLS for the Occupational Employment Statistics (OES) program modified by Kentucky
9.	Data Collection Personnel	Graduate students hired by OESC	Personnel from various state agencies
10.	Collection Personnel Training	One week, conducted by OESC	1½ days, conducted by OTIS, Inc.
11.	Survey Response Results		
	. Number contacted	2,636	2,307
	. Usable responses	1,865	2,175
	. Response ratio	71 percent	94 percent
	. Establishment employment	84 percent	
12.	Data modification	OESC personnel review all data for accuracy and modify where necessary	Missing and/or incorrect data are returned to Industrial Coordinator

reliable employment demand forecasts and to establish rapport among the public and private sector organizations involved.

(1) Oklahoma Contacts Sample Employers By Personal Visits And By Mail

As noted earlier, during the early stages of OTIS development, Oklahoma endeavored to collect demand data from all employers on a census basis. Vocational education personnel were utilized to collect these data. This method was found to be very expensive and was not utilized.

Currently, demand data are collected through a sample of state employers conducted by OESC. The largest employers in terms of total employment are contacted personally. The remaining firms receive survey questionnaires in the mail and are contacted personally only if an adequate response for a particular cell is not received.

In Oklahoma, baseline data are collected every four years and are updated annually to include new firms and significant employment changes for listed firms. As noted in Exhibit VII, following page 18, the 1971 sample survey was stratified as follows:

- OESC records were utilized to identify all businesses that paid a wage to four or more workers in each of 20 weeks.
- The state was divided into 11 state planning districts.
- The employers in each industry division in each district were ranked in descending order by total employment.
- The employers in each area were divided into quartiles, based on total employment per firm.

- The sample was selected as follows:
  - 100 percent of the first two quartiles
  - 20 percent of the third quartile
  - 5 percent of the fourth quartile
- The selected sample was adjusted to include noncovered firms and major employers not otherwise included in the sample stratification.

Overall, the Oklahoma sample included 416 manufacturing and 2,217 nonmanufacturing establishments employing approximately 375,000 people. The response rate for the sample was approximately 71 percent, or 1,865 reporting units.

The most recent demand data in Oklahoma were collected by graduate students utilizing survey questionnaires developed by OESC. These questionnaires included more than 280 occupations classified by the Dictionary of Occupational Titles (DOT) code. A sample questionnaire is included in Appendix D. Employers were asked to forecast the demand for each occupation for two- and four-year periods.

(2) Kentucky Conducts A Personal Interview Census

The initial Kentucky demand data collection activities focused on conducting a census of the manufacturing employers listed in the Kentucky Directory of Manufacturers, published by the State Department of Commerce. Thus, Kentucky data collection does not involve a stratified sample such as was undertaken in Oklahoma. Instead, all manufacturers were surveyed with the following results, as of September, 1973.

- 2,946 employers were in the universe.
- 2,855 employers were contacted.
- 374 were nonmanufacturers, who were thereby eliminated from the survey population.

- 275 firms were determined to be inactive, i.e., out of business.
- 69 employers refused to respond.
- 61 employers never were contacted.

Thus, a total of 2,175 usable responses, exclusive of nonmanufacturing and inactive firms, were received, giving an overall usable response rate of approximately 94 percent. Employers responding employ approximately 214,000 of the 234,500 manufacturing employees.

The demand data were collected by over 500 individuals, including vocational education teachers and a variety of individuals from other agencies. Thirty-four different Bureau of Labor Statistics (BLS) Occupational Employment Survey (OES) questionnaires, including some 1,400 occupations, were utilized to collect the data. A sample questionnaire is contained in Appendix D. Employers were asked to forecast manpower demand by occupation for one- and two-year periods.

2. THE FORECAST OF MANPOWER DEMAND MADE BY EMPLOYERS PARTICIPATING IN THE OKLAHOMA RESURVEY WAS UNDERESTIMATED

The nucleus of the entire OTIS system is the interface of projected manpower demand with estimated manpower supply. The forecasts of manpower demand are prepared by employers. Therefore, an assessment of the accuracy of these employer forecasts is crucial to an evaluation of the OTIS demand data collection methodology.

An assessment of the overall reliability of the OTIS demand data requires an analysis of all aspects of employment forecasting both by firm and by regional summaries of occupational data. Relevant questions concerning the ability of individual employers to forecast include:

- Are specific, individual employer forecasts accurate?
- Does the accuracy vary by type of forecast, e.g., change or no change, or by size in terms of employment?
- Are the aggregate forecasts of employers in some industries better than in others?
- Are forecast errors associated with particular independent variables, e.g., number of occupations?

More general questions concerning the occupational forecast include:

- Are the regional summaries of manpower demand by occupation accurate?
- Do the forecasts of "All Remaining Employees" adversely affect the overall accuracy of the occupational projections?
- Does clustering improve the accuracy of the regional summaries?

To answer questions of this type, a comparison of the OTIS forecast employment figures with actual employment figures is necessary. Therefore, the Project Monitoring Committee decided to resurvey 200 firms that had participated in the current OTIS survey in Oklahoma. The resurvey was undertaken at the end of the two-year forecast period, thereby enabling forecast employment data to be compared with current actual employment. The resurvey methodology, including sample selection and survey procedures, is described in Appendix E. The results of this comparison indicated that the forecast of manpower demand was underestimated by 1, 342 positions. This understatement represents an error of 4 percent when compared to actual employment and 96 percent when related to actual change in employment. During the forecast period, employment in Oklahoma, excluding agriculture, increased approximately 9 percent.[1]

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[1] Unpublished BLS data

Alternative statistics for evaluating the accuracy of the OTIS forecast were being developed concurrently with data preparation. After extensive analysis, the Project Monitoring Committee decided to use the following three statistical measures to evaluate the accuracy of the OTIS demand data.

- U Statistic--This statistic was developed by Henri Theil[1] and has been used previously to evaluate the accuracy of employer forecasts of manpower demand.[2] The U Statistic is calculated as follows:

$$U = \sqrt{\frac{\Sigma(P_i - A_i)^2}{\Sigma A_i^2}}$$

where P_i and A_i stand for predicted and actual changes. Thus, it can be seen that $U = 0$ only if all forecasts are perfect and that $U = 1$ when the prediction error is of the same magnitude as a no-change extrapolation. In other words, "by using the inequality coefficient one measures the seriousness of a prediction error by the quadratic loss criterion in such a way that the zero corresponds with perfection and the unit with the loss associated with no-change extrapolation. It will be clear that the inequality coefficient has no finite upper bound, which is tantamount to saying that it is possible to do considerably worse than by extrapolating on a no-change basis."[1] However, as discussed subsequently and illustrated by the OTIS data, the U value of an incorrect "no-change" forecast is 1.0 regardless of the magnitude of the error.

- Statistic I--This is a relatively simple statistic that relates the forecast error to total actual employment. The formula for deriving Statistic I is:

$$\text{Statistic I} = \frac{\text{Total Forecast} - \text{Total Actual}}{\text{Total Actual}}$$

The forecast error is computed using only total employment for the employer or particular aggregation. Thus, errors in individual occupational forecasts, comprising the employers' total forecast, can be offset by other line items or by the regional summaries.

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[1] Theil, Henri, Applied Economic Forecasting, Rand McNally & Company, Chicago, 1966.

[2] Moser, Collette H., An Evaluation Of Area Skill Surveys As A Basis For Manpower Policies, an unpublished doctoral dissertation at the University of Wisconsin, 1971.

- Statistic II--This statistic relates the forecast error to the actual change in employment over the forecast period and is computed as follows:

  $$\text{Statistic II} = \frac{\text{Total Forecast} - \text{Total Actual}}{\text{Total Actual} - \text{Total Original}}$$

  Similar to Statistic I, this indicator allows canceling of internal errors and considers only the total employment of the employer or other aggregation. In the case of an incorrect no-change forecast, Statistic II is always 1.0 because the total forecast equals total original employment.

A complete explanation, including the derivation, limits, special cases, and interpretations of each of these statistics, is presented in Appendix F.

Our resurvey of employers in Oklahoma indicated that the forecast of total employment statewide was understated. The three statistics described above were utilized to evaluate the overall accuracy of employer forecasts. The results of these analyses indicated that:

- Forecast accuracy varied widely by firm.
- Type of forecast and employment size did not substantially affect accuracy.
- Forecast accuracy varied by industry.
- Accuracy of the occupation forecast varied by region.
- Clustering did not improve accuracy substantially.
- Forecast figures for "All Remaining Employees" did not adversely affect the accuracy of the total forecast.

These analyses and resultant findings are presented in the succeeding sections.

(1) Forecast Accuracy Varied Widely Among Firms

The accuracy of the manpower demand forecast made by the 193 employers in Oklahoma participating in the resurvey varied widely.

Exhibit VIII, following this page, presents the distribution of employers for each error statistic. The complete distribution by region for each statistic is included in Appendix G. A sample printout for a firm is also included in this appendix.

As shown in Exhibit VIII, the range of U varies from 0 to over 2.0000. The distribution of forecasts within this range is as follows:

- Some 15, or approximately 7.8 percent, of the forecasts were perfect. Given the characteristics of the U Statistic, this means that the individual forecasts for each of the occupations were perfect.

- A total of 17, or approximately 8.8 percent, of the forecasts had a U value between .0001 - .5999.

- Some 43, or about 22.2 percent, of the forecasts showed a U of from .6000 - .9999.

- A total of 72, or about 36.7 percent, of the forecasts had a U value of 1.0000. The large number of employers having a unit value is due to the high incidence of incorrect no-change forecasts.

- Some 46, or 24.5 percent, of the forecasts had a U value of 1.0001 or over.

This analysis of the U Statistic values indicates that over 60 percent of the forecasts did not decrease the inaccuracy which would have occurred had a simple, no-change extrapolation been used. More importantly, many of these forecasts were more inaccurate. Therefore, a more accurate forecast would have been available if a simple, no-change extrapolation had been utilized.

As noted earlier, Statistic I relates the forecast error to total actual employment at the time of resurvey. This tends to narrow the range of the statistic because of the relatively large base. Even so, the Statistic I values range from over -.500 to over +.500. The distribution of forecasts within this range is described subsequently.

EXHIBIT VIII

Economic Development Administration

DISTRIBUTION OF ERROR STATISTICS IN OKLAHOMA

U Statistic

Number of Employers	Value
15	0
2	.0001 - .1999
3	.2000 - .3999
12	.4000 - .5999
13	.6000 - .7999
30	.8000 - .9999
72	1.0000
19	1.0001 - 1.2500
13	1.2501 - 1.5000
2	1.5001 - 1.7500
3	1.7501 - 2.0000
9	Over 2.0000

Statistic I

Number of Employers	Value
10	- Over .500
13	-.251 - .500
6	-.201 - .250
9	-.151 - .200
8	-.101 - .150
18	-.051 - .100
23	-.001 - .050
26	0
21	+.001 - .050
12	+.051 - .100
12	+.101 - .150
7	+.151 - .200
7	+.201 - .250
10	+.251 - .500
11	+ Over .500

Statistic II

Number of Employers	Value
28	- Over 1.000
80	-.801 - 1.000
9	-.601 - .800
14	-.401 - .600
3	-.201 - .400
5	-.001 - .200
26	0
3	+.001 - .200
3	+.201 - .400
2	+.401 - .600
1	+.601 - .800
5	+.801 - 1.000
14	+ Over 1.000

- Some 26, or approximately 13.5 percent, of the forecasts were perfect. The majority of these were no-change forecasts.
- Some 87, or approximately 45.1 percent, of the forecasts were low.
- The remaining 80 employer forecasts, or 41.4 percent, were high.

Ignoring plus and minus signs, the forecast error, when compared to actual employment resulted in:

- Some 74, or 38.3 percent, of the forecasts had a Statistic I value from .001 - .100.
- Some 36, or approximately 18.7 percent, of the forecasts had a Statistic I value of from .101 - .200.
- Another 36, or approximately 18.7 percent, of the forecasts had a Statistic I value between .201 - .500.
- The remaining 21, or 10.9 percent, of the forecasts had a Statistic I value of over .500.

Thus, nearly 30 percent of the firms made forecast errors of over 20 percent when compared to total actual employment.

Statistic II relates the error in the forecast to the actual change in total employment over the forecast period. Thus, the range of values for Statistic II is usually high when compared to Statistic I because of the much smaller base. Obviously, the same number of employers made a perfect forecast in the Statistic II as in Statistic I. Ignoring the signs, the range of forecast values is as follows.

- Some 14, or approximately 7.4 percent, of the forecasts had a Statistic II value between .001 - .400.
- Some 26, or 13.5 percent, of the forecasts had a Statistic II value between .401 - .800.

- A total of 85, or 44.1 percent, of the forecasts had a value between .801 - 1.000. Similar to the U Statistic, the high incidence of unit values is due to the fact that the value for this statistic is one, if there is any error in a no-change forecast. Thus, an error of one employee or 400 employees results in a unit value.

- The remaining 42, or 21.8 percent, of the forecasts had a Statistic II value of over 1.000.

Thus, over half of the employers had a forecast error equal to or greater than the actual change in employment.

(2) Type Of Forecast And Employment Size Did Not Substantially Affect Forecast Accuracy

Eighty-two, or approximately 40 percent, of the employers participating in the resurvey had originally made "no-change" forecasts, i.e., they predicted no change in total employment or shifts of employment among occupations. No-change forecasts are difficult to evaluate. For example, they can represent the informed judgment of the employer or, as discussed later, can indicate an inability or unwillingness to forecast.

As noted earlier, for a no-change forecast the U Statistic values are either 1.0 or 0. In addition, the Statistic II value for an incorrect no-change forecast is 1.0. More importantly, it had been hypothesized that smaller companies cannot forecast accurately and that the occupational codes do not fit in small companies when workers often perform a large number of varied tasks. Consequently, it was decided to evaluate the impact of type of forecast and employment size on forecast accuracy.

Exhibit IX, following this page, presents the forecast statistics by type of forecast and size of employment. Appendix H contains the summary source data for this array. The U Statistic value for a particular employer is computed using the predicted and actual change for each occupation. The computation of the forecast error for Statistics I and II

EXHIBIT IX

Economic Development Administration

SUMMARY OF OKLAHOMA FORECASTS
BY TYPE AND EMPLOYMENT SIZE

Type of Forecast/ Actual Employment	Number of Employers	Number of Employees			Average Statistics			Total Statistics		
		Original	Forecast	Actual	U	I	II	U	I	II
1. No Change										
(1) 0 - 100	62	1,908	1,908	2,028	0.85484	0.32529	0.77419	1.00000	-.05917	-1.00000
(2) 101 - 250	16	2,148	2,148	2,404	1.00000	0.15212	0.87500	1.00000	-.10649	-1.00000
(3) Over 250	4	2,064	2,064	1,724	1.00000	0.13149	1.00000	1.00000	+.19722	-1.00000
2. Change										
(1) 0 - 100	54	1,831	2,130	1,946	1.08490	0.35537	1.67940	1.60000	+.09455	+1.60000
(2) 101 - 250	29	4,689	5,108	5,201	1.12751	0.16293	1.49940	0.57440	-.01788	-0.18164
(3) Over 250	28	21,018	22,615	24,012	1.00228	0.14785	1.41012	0.46500	-.05818	-0.46660
Total	193	33,658	35,973	37,315	-	-	-	0.36666	-.03596	-0.36697
Average	-	-	-	-	0.99661	0.26879	1.24175	-	-	-

uses the totals for an employer, thus allowing some offsetting of errors in the projections for individual occupations. In order to prevent additional offsetting errors, an average value for U, Statistic I, and Statistic II was computed using the values for all employers in each of the six categories. The averages for Statistics I and II were computed using absolute values, i.e., ignoring the signs.

The average error statistics for all firms are:

- 0.99661 for the U Statistic
- 0.26879 for Statistic I
- 1.24175 for Statistic II

As Exhibit IX shows, the averages of the employers in each of the six categories are similar to the average for all employers, with minor exceptions.[1] The slightly lower values of U for employers who made "no-change" forecasts reflect the fact that the upper limit of U for a no-change forecast is 1.0000, regardless of the magnitude of the forecast error. Similarly, Statistic II tends toward the unit for incorrect no-change forecasts. These data also indicate that the average value for Statistic I for small firms is higher than the overall average regardless of the type of forecast. This is probably due to the fact that forecast errors are related to a smaller base in small firms than in large firms.

Exhibit IX also presents the three statistics computed using the number of original, forecast, and actual employees in each category and statewide. This allows additional errors to be offset among the firms in each category. Consequently, the statistics reflect a higher degree of accuracy at this level of aggregation.

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[1] The results of a multiple regression analysis conducted using the EDA BIOMED Stepwise Multiple Regression package indicated that the ability of an employer to forecast accurately was not associated with type of forecast, number of employees, or number of occupations.

(3) Some Variation Occurs In Forecast Accuracy By Industry

Exhibit X, following this page, displays the values for U, Statistic I, and Statistic II by industry. Similar to the preceding array by type of forecast and employment size, these values are the averages of all employers in a particular industry. Values of Statistic I and Statistic II were computed using absolute values, i.e., ignoring the signs. The range of values is:

- U Statistic ranges from 0.85152 to 1.17823. The average for all industries is 0.99661.
- Statistic I ranges from 0.13288 to 0.91375. The average for all industries is 0.26879.
- Statistic II ranges from 0.82835 to 1.86111. The average for all industries is 1.24175.

In our judgment, the statistics are relatively high, indicating poor forecast accuracy. However, the statistics do indicate that the Finance, Insurance, and Real Estate Industry and the Medical and Health Service Industry forecasts are more accurate than average forecasts of employers in Construction and Durable Goods Manufacturing Industries.

(4) The Accuracy Of The OTIS Occupational Forecast Varied By Region

The previous analyses were concerned with the ability of an employer or group of employers to accurately forecast manpower demand by occupation and in total. As described in Chapter II, the data produced and utilized by OTIS are regional summaries of net manpower requirements by occupation and/or occupational cluster. Thus, the accuracy of the net requirements forecast by occupation is a function of the accuracy of the demand forecast. Consequently, the accuracy of the forecast for manpower demand by occupation must be determined.

EXHIBIT X

Economic Development Administration

SUMMARY OF OKLAHOMA FORECASTS BY INDUSTRY

Industry	Number of Employers	Number of Employees			Average Statistics		
		Original	Forecast	Actual	U	I	II
Construction	6	198	231	251	1.04066	0.80963	1.86111
Durable Goods Manufacturing	23	6,189	7,167	8,261	1.17823	0.24389	1.15328
Finance, Insurance, and Real Estate	31	2,645	2,812	2,860	0.85152	0.13288	1.19629
Medical and Health Services	12	2,804	2,964	3,363	0.89481	0.15946	0.82835
Mining	15	1,014	1,008	915	0.87052	0.91375	1.33384
Nondurable Goods Manufacturing	18	4,544	4,789	4,519	1.13508	0.17968	1.41440
Public Utilities	23	8,369	8,693	8,951	1.13887	0.14471	0.97322
Service	12	401	430	389	0.99336	0.54991	1.68518
Trade	53	7,494	7,879	7,806	0.94838	0.15511	1.28048
Total	193	33,658	35,973	37,315	-	-	-
Average	-	-	-	-	0.99661	0.26879	1.24175

As part of our analyses, the occupational projections of each employer in a region were totaled to obtain regional summaries of manpower demand by occupation. A sample summary is included in Appendix H. The accuracy of these summary data was evaluated using the same three error statistics used to evaluate employer forecasts. Exhibit XI, following this page, displays the error statistics for the occupational summary in each region. Errors among employers for a specific occupation are netted out before any calculations are made. These statistics were computed in the same way as the statistics for an individual employer.

- The U Statistic was computed using the predicted and actual changes for each occupation in the summary.
- Statistic I was computed using the totals for all of the occupations in the region, thereby allowing some offsetting errors among occupations to net out.
- Statistic II was also computed using the totals for all occupations, thereby allowing some errors to be offset.

As indicated in the exhibit, the statistics vary in value by region. Excluding regions 1 and 11 because they have relatively small numbers of employees and extremely large error statistics, the range and average for each of the three statistics are:

- The U Statistic ranges in value from 0.6727 to 1.1492. The average U for the remaining nine regions is 0.9393.
- Statistic I ranges in value from 0.0177 to 0.1760. The average, computed using absolute values, is 0.0641.
- Statistic II ranges in value from 0.0848 to 0.6731. The average, computed using absolute values, is 0.5288.

The regional performance varies by statistic. For the U Statistic, regions 2 and 4 made the best forecast and regions 3 and 5 the worst. Based on Statistic I values, regions 3 and 9 made the best forecast and regions 4

EXHIBIT XI

Economic Development Administration

OKLAHOMA OCCUPATIONAL FORECASTS BY REGION

Region	Number of Employees			Statistics		
	Original	Forecast	Actual	U	I	II
1	519	568	524	1.1498	.0840	8.8000
2	1,965	2,056	2,210	0.6727	-.0697	-0.6286
3	574	753	739	1.1492	.0189	0.0848
4	1,204	1,353	1,642	0.8216	-.1760	-0.6598
5	738	814	789	1.1109	.0317	0.4902
6	3,435	3,556	3,711	0.8240	-.1027	-0.6558
7	1,851	1,969	2,212	0.9583	-.1099	-0.6731
8	16,150	17,092	16,715	1.0334	.0226	0.6673
9	526	554	564	0.9107	-.0177	-0.2632
10	245	249	256	0.9725	-.0273	-0.6364
11	487	565	519	4.4795	.0886	1.4375
Total	33,658	35,973	37,315	-	-	-
Average (9 Regions)	-	-	-	0.9393	.0641	0.5288

and 7 the worst. In addition, region 8, the largest region in terms of employment, had an excellent Statistic I value of approximately 2 percent. For Statistic II, regions 3 and 9 made the best forecast and regions 7 and 8 the worst.

(5) Combining Occupational Totals Did Not Significantly Improve The Accuracy Of The Test Clusters

The preceding section discussed the accuracy of the regional summaries of manpower demand by occupation. The basic finding was that the occupational forecasts were often inaccurate. However, OTIS groups various occupations into vocational education training clusters and publishes summary data by cluster. This procedure combines occupational totals, thereby providing opportunity to offset or average errors in individual occupations. Therefore, to fully understand the entire forecasting problem, an examination of the impact of clustering on forecast accuracy was required.

Based on an examination of the OTIS Cycle Five Report, EDA decided to examine six clusters in four regions and on a statewide basis. Data from the resurvey were clustered and analyzed using the three error statistics. Exhibit XII, following this page, presents the results of this analysis. In general, the forecast accuracy was not substantially improved. The principal reason for this lack of major improvement is that many of the forecasts in a particular cluster tended to be either low or high, rather than a combination of some high forecasts with some low forecasts. Consequently, errors for individual occupations were averaged as a result of clustering rather than reduced substantially by offsetting errors in the occupational forecasts.

EXHIBIT XII

Economic Development Administration

FORECAST ACCURACY BY CLUSTER IN SELECTED REGIONS IN OKLAHOMA

Cluster	Region	Number of Employees			Statistics		
		Original	Forecast	Actual	U	I	II
Carpentry	4	16	20	19	0.332	0.053	0.333
	6	50	55	55	0.686	0.000	0.000
	7	35	38	36	1.141	0.056	2.000
	8	143	165	145	1.952	0.138	10.000
	State	342	379	353	1.439	0.074	2.364
Practical (Vocational) Nursing (Not a Cluster)	4*	--	--	--	--	--	--
	6*	--	--	--	--	--	--
	7	6	9	7	2.000	0.285	2.000
	8*	--	--	--	--	--	--
	State	218	252	244	0.531	0.033	0.308
Electricity/Electronic Technology/Electromechanical Technology	4	1	2	46	0.978	-0.956	-0.978
	6	5	8	1	1.749	7.000	1.750
	7	4	4	4	0.000	0.000	0.000
	8	12	12	12	0.000	0.000	0.000
	State	55	60	87	0.872	-0.310	-0.844
Machine Shop/Machine Tool Operation	4	8	12	10	1.000	0.200	1.000
	6	189	216	234	1.135	-0.077	0.400
	7	12	14	14	0.000	0.000	0.000
	8	110	125	156	0.603	-0.198	-0.674
	State	373	426	470	0.848	-0.094	-0.454
Accounting and Computing	4	50	53	57	1.118	-0.070	-0.571
	6	551	570	645	0.907	-0.116	-0.798
	7	199	211	181	1.265	0.166	1.667
	8	808	865	876	0.757	-0.013	-0.162
	State	1,876	1,974	2,079	0.812	-0.051	-0.517
Transportation/Truck Driver	4	72	88	104	0.826	-0.154	-0.500
	6	696	695	819	0.907	-0.151	-1.008
	7	45	45	47	0.906	-0.043	-1.000
	8	37	46	65	0.680	-0.292	-0.679
	State	1,882	2,029	2,188	0.572	-0.073	-0.520

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* Resurvey data not available

(6) The Forecast For The "All Remaining Employees" Category Did Not Affect The Overall Forecast Adversely

The survey instruments used to collect the OTIS demand data contain a "catch-all" occupational category called "All Remaining Employees." The use of this category simplified data collection and preparation. Since over 30 percent of total manpower demand is reported in this category, an analysis of the impact of the "All Remaining Employees" category on forecast accuracy is required to complete the forecast picture.

Exhibit XIII, following this page, presents the results of our analysis of the effect on forecast accuracy of the "All Remaining Employees" category. This analysis is based on a comparison of Statistic I and II for total employment and adjusted total employment. The adjusted total was computed by subtracting "All Remaining Employees" from total employment. As indicated in the exhibit, the adjusted total was:

- More accurate in three regions
- Less accurate in six regions
- Approximately the same in two regions

The statewide totals were also approximately equal. Thus, the inclusion of the "catch-all" category did not affect forecast accuracy adversely.

3. THE FORECAST OF MANPOWER DEMAND MADE BY EMPLOYERS PARTICIPATING IN THE KENTUCKY RESURVEY WAS OVERESTIMATED

This section presents our analysis of the accuracy of the employer and occupational forecasts in Kentucky. The analyses, error statistics, and calculations are similar to the procedures utilized to assess the OTIS data in Oklahoma. In contrast to the resurvey of about 200 employers in Oklahoma at the end of an approximate two-year forecast period, the resurvey in Kentucky was undertaken at the end of a one-year forecast period, and included 301 firms. The resurvey methodology, including sample selection and survey procedures, is described in Appendix E. The results of a comparison of forecast and actual

EXHIBIT XIII

Economic Development Administration

ALL REMAINING EMPLOYMENT FOR OKLAHOMA

Region	Category	Number Of Employees			Statistics	
		Original	Forecast	Actual	I	II
1	All Remaining	144	166	140	0.1857	-6.5000
	Total	519	568	524	0.0840	8.8000
	Adjusted Total	375	402	384	0.0469	2.0000
2	All Remaining	594	642	718	-0.1058	-0.6129
	Total	1,965	2,056	2,210	-0.0697	-0.6286
	Adjusted Total	1,371	1,414	1,492	-0.0523	-0.6446
3	All Remaining	122	134	137	-0.0219	-0.2000
	Total	574	753	739	0.0189	0.0848
	Adjusted Total	452	619	602	0.0283	0.1133
4	All Remaining	276	304	301	0.0100	0.1200
	Total	1,204	1,353	1,642	-0.1760	-0.6598
	Adjusted Total	928	1,049	1,341	-0.2177	-0.7070
5	All Remaining	229	260	246	0.0569	0.8235
	Total	738	814	789	0.0317	0.4902
	Adjusted Total	509	554	543	0.0202	0.3235
6	All Remaining	3,435	3,556	3,711	-0.0418	-0.5616
	Total	9,399	10,000	11,145	-0.1027	-0.6558
	Adjusted Total	5,964	6,444	7,434	-0.1332	-0.6735
7	All Remaining	373	389	380	-0.4941	-0.9596
	Total	1,851	1,969	2,212	-0.1099	-0.6731
	Adjusted Total	1,478	1,580	1,832	-0.1375	-0.7119
8	All Remaining	5,896	6,074	5,863	0.0360	-6.3939
	Total	16,150	17,092	16,715	0.0226	0.6673
	Adjusted Total	10,254	11,018	10,852	0.0153	0.2776
9	All Remaining	140	152	169	-0.1006	-0.5862
	Total	526	5[illegible]4	564	-0.0177	-0.2632
	Adjusted Total	386	402	395	-0.0177	0.7778
10	All Remaining	35	36	70	-0.4857	-0.9714
	Total	245	249	256	-0.0273	-0.6364
	Adjusted Total	210	213	186	0.1452	-1.1250
11	All Remaining	51	51	49	0.0408	-1.0000
	Total	487	565	519	0.0886	1.4375
	Adjusted Total	436	514	470	0.0936	1.2941
Total All Regions	All Remaining	11,295	11,764	12,173	-0.0336	-0.4658
	Total	33,658	35,973	37,315	-0.0360	-0.3670
	Adjusted Total	22,363	24,209	25,142	-0.0371	-0.3357

employment indicated that the forecast of demand was overestimated by 1,100 positions. This overstatement represents an error of 2 percent when compared to actual employment and 98 percent when related to actual change in employment. During the forecast period, manufacturing employment in Kentucky increased by approximately 6.5 percent.[1]

Our analysis of the Kentucky resurvey data indicated that manpower demand was overstated. Specifically, the results of our analysis indicate that:

- Forecast accuracy also varied widely among employers.
- Forecast accuracy was not influenced substantially by type of forecast or employment size.
- Significant variations in accuracy by industry did not occur.
- Accuracy of the occupational forecast varied by region.
- Clustering did not improve forecast accuracy significantly.

These findings are discussed in the following sections.

(1) Forecast Accuracy In Kentucky Also Varied Substantially Among Employers

Forecast accuracy among the 301 manufacturing employers in Kentucky participating in our resurvey also varied widely. Exhibit XIV, following this page, presents the distribution of employers for each of the three error statistics. The complete distribution by region for each statistic is included in Appendix G. A sample printout for a manufacturing firm in Kentucky also is included in this appendix.

As shown in Exhibit XIV, the range of the U Statistic varies from 0, or a perfect forecast, to over 2.0000. The distribution of forecasts within this range is:

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[1] Insured employment figures from Kentucky Department of Labor.

EXHIBIT XIV

Economic Development Administration

DISTRIBUTION OF ERROR STATISTICS IN KENTUCKY

U Statistic		Statistic I		Statistic II	
Number of Employers	Value	Number of Employers	Value	Number of Employers	Value
33	0	7	- Over .500	60	- Over 1.000
--	.0001 - .1999	19	-.251 - .500	127	-.801 - 1.000
2	.2000 - .3999	8	-.201 - .250	7	-.601 - .800
3	.4000 - .5999	4	-.151 - .200	12	-.401 - .600
9	.6000 - .7999	15	-.101 - .150	9	-.201 - .400
25	.8000 - .9999	26	-.051 - .100	5	-.001 - .200
137	1.0000	36	-.001 - .050	42	0
49	1.0001 - 1.2500	42	0	1	+.001 - .200
15	1.2501 - 1.5000	27	+.001 - .050	3	+.201 - .400
4	1.5001 - 1.7500	32	+.051 - .100	5	+.401 - .600
7	1.7501 - 2.0000	20	+.101 - .150	5	+.601 - .800
17	Over 2.0000	11	+.151 - .200	1	+.801 - 1.000
		7	+.201 - .250	24	+ Over 1.000
		31	+.251 - .500		
		16	+ Over .500		

- Some 33, or approximately 11 percent, of the forecasts were perfect forecasts. As noted earlier, a perfect forecast requires the forecast for each individual occupation to be correct.

- A further 39, or approximately 13 percent, of the forecasts had a U value between .0001 - .9999.

- Some 137, or 45.5 percent, of the forecasts had a U value of 1.0000. The high incidence of firms with a U value of 1.0000 is caused by the large number of incorrect no-change forecasts. As noted earlier, an error in a no-change forecast results in a unit value for the statistic, regardless of magnitude.

- A total of 92, or slightly over 30 percent, of the forecasts had a U value of 1.0001 or over.

These results indicate that, in over 75 percent of the forecasts, the error was either equal to or greater than the error associated with a simple no-change forecast. In other words, in the majority of the cases, a simple no-change extrapolation of current employment at the time the survey was taken would have yielded results equal to or better than those obtained from the forecast.

The Statistic I values range from over -.500 to over +.500. The forecasts are distributed fairly evenly throughout this range. Specifically, of the 301 forecasts:

- Some 42, or 14 percent, of the total were perfect forecasts. The majority of these were no-change forecasts. A higher number of perfect forecasts occur in this statistic than in the U Statistic because only the totals and not all of the occupational forecasts must be accurate.

- A group of 115, or approximately 38.2 percent, forecast manpower demand below actual.

- The remaining 144 employers, or 48 percent, forecast a higher demand than was observed.

Using the absolute values, the range of forecast errors compared to actual employment is:

- Some 121, or over 40 percent, of the forecasts had a Statistic I value of from .001 to .100.

- Some 50, or approximately 16.6 percent, of the total had a Statistic I value of from .101 to .200.

- A further 65, or approximately 21.6 percent, of the total had a Statistic I value of from .201 to .500.

- The remaining 23, or approximately 7.6 percent, of the forecasts had a Statistic I value of over .500.

Thus, over 29 percent of the employers made forecast errors of over 20 percent when compared to total actual employment.

The range of Statistic II varies from over -1.000 to over +1.000. The range of this statistic is greater than the range for Statistic I because the same forecast error is applied to actual change in employment rather than total actual employment. Fourteen percent, or 42 employers, made perfect forecasts. Ignoring the signs, the range of forecast values is:

- Some 18, or 6 percent, of the forecasts had a Statistic II value of from .001 to .400.

- Some 29, or about 9.5 percent, of the total had a Statistic II value of from .401 to .800.

- A total of 128, or nearly 43 percent, of the forecasts had a Statistic II value between .801 and 1.000. The large number of employers in this range is caused by the high incidence of incorrect no-change forecasts, which result in a unit value.

- The final 84, or nearly 28 percent, of the forecasts had a Statistic II value of over 1.000.

These data indicate that over half of the firms made a forecast error equal to or greater than the actual change in employment over the forecast period.

(2) Forecast Accuracy Was Not Affected Substantially By Type Of Forecast Or Employment Size

Nearly one-half of all of the forecasts in the initial OTIS survey were no-change forecasts. As noted earlier, it is difficult to identify the reason for a no-change forecast. More importantly, as discussed later, many no-change forecasts in Kentucky were actually no forecasts.

Exhibit XV, following this page, presents the forecast statistics by type of forecast and employment size. Appendix H contains the summary source data for this array. The U value for a particular employer is computed using both the predicted and actual changes for each occupation. The computation of the forecast error for Statistics I and II uses the totals for an employer, thus allowing offsetting of errors among the occupations. In order to prevent additional offsets, an average value for U, Statistic I, and Statistic II was computed using the values for all employers in each of the six categories. The averages for Statistics I and II were computed using absolute values. The average error statistics for all employers is:

- 1.08004 for the U Statistic
- 0.30372 for Statistic I
- 1.88408 for Statistic II

A comparison of the statistics in each category with the averages indicates substantial departures. In our judgment, however, these departures reflect the characteristics of the error statistics and do not indicate differing abilities to forecast among the groups.[1] For example, the much lower values of U for no-change forecasts reflect the fact that the upper limit of U for a no-change forecast is 1.0. Thus, with an infinite upper limit possible in change forecasts, the average is higher. Additionally,

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[1] The results of a multiple regression analysis conducted using the EDA BIOMED Stepwise Multiple Regression package indicated that the ability of an employer to forecast accurately was not associated with type of forecast, number of employees, or number of occupations.

EXHIBIT XV

Economic Development Administration

SUMMARY OF KENTUCKY FORECASTS
BY TYPE AND EMPLOYMENT SIZE

Type of Forecast/ Actual Employment	Number of Employers	Number of Employees			Average Statistics			Total Statistics		
		Original	Forecast	Actual	U	I	II	U	I	II
1. No Change										
(1) 0 - 100	97	2,962	2,962	2,957	0.72164	0.27613	0.69070	1.00000	.00169	- 1.00000
(2) 101 - 250	23	3,763	3,763	3,846	0.95652	0.10778	0.91304	1.00000	-.02158	- 1.00000
(3) Over 250	30	20,678	20,678	20,853	0.95635	0.12204	0.93330	1.00000	-.00839	- 1.00000
2. Change										
(1) 0 - 100	80	2,809	3,379	2,753	1.60102	0.56853	3.61390	10.00000	.22739	-11.17857
(2) 101 - 250	33	5,080	5,727	4,873	1.27257	2.47655	2.63030	4.12500	.17525	- 4.12560
(3) Over 250	38	24,175	25,183	25,310	1.23730	0.11276	1.97880	0.11500	-.00502	- 0.11189
Total	301	59,467	61,692	60,592	-	-	-	0.97777	.01815	- 0.97778
Average	-	-	-	-	1.08004	0.30372	1.88408	-	-	-

the statistics do not indicate that accuracy varies by size of employment. However, they do indicate that Statistics I and II are higher for small firms. In our judgment, this is due to applying a forecast error to a smaller base in both cases, e.g., the actual employment and probably the actual changes are smaller in small firms than in large firms.

Exhibit XV also presents the three statistics computed using the number of original, forecast, and actual employees in each category and statewide. This allows additional errors to be offset among the firms in each category. However, with the exception of Statistic I, the statistics are still relatively high.

(3) Forecast Statistics Do Not Indicate Major Industry Differences

Exhibit XVI, following this page, displays the average value for U, Statistic I, and Statistic II of the employers in each industry classification to the values for Statistics I and II, computed using the absolute values for each employer. The range of the average values is:

- U Statistic ranges in value from 0.061953 to 2.72777. The average for all industries is 1.08004.
- Statistic I ranges in value from 0.00870 to 0.65428. The average for all industries is 0.30372.
- Statistic II ranges in value from 0.60000 to 7.50000. The average for all industries is 1.88408.

Most of the statistics are relatively high, indicating inaccurate forecasts by industry. More importantly, these averages do not indicate a clearcut example of one industry producing better forecasts than others for all three statistics. For example, the best forecast in U, Statistic I, and Statistic II, respectively, are the Leather and Leather Product Industries, Petroleum Refining and Coal Product, and the Musical Instruments Industries. The worst industries were the Nonferrous Rolling and Drawing/ Miscellaneous Primary Metal Products, Tobacco, and Stone Products

EXHIBIT XVI

Economic Development Administration

SUMMARY OF KENTUCKY FORECASTS BY MANUFACTURING INDUSTRY

Manufacturing Industry	Number of Employers	Number of Employees			Average Statistics		
		Original	Forecast	Actual	U	I	II
Metal Working	97	21,455	22,763	21,881	1.25095	0.31833	2.01965
Meat Packing	6	1,093	1,099	1,123	1.00425	0.32323	1.25000
Dairy Products	9	416	434	493	0.62241	0.11623	1.56771
Canned and Preserved Fruits, Vegetables, and Seafood	3	536	635	475	1.71799	0.21418	4.77419
Grain Mill Products, Sugar, Confectionary, and Misc. Foods	9	564	572	570	1.17702	0.10006	1.22222
Bakery Products	1	200	200	203	1.00000	0.01478	1.00000
Beverage Products	16	3,275	3,254	3,241	1.06617	0.21357	2.11035
Tobacco Industry	6	3,709	3,852	3,634	0.84779	0.65428	0.92394
Textile Mill Products	5	1,654	1,770	1,829	0.84351	0.10315	0.98093
Apparel and Other Textile Products Industries	18	5,476	5,590	5,939	0.98403	0.15759	2.16494
Lumber and Wood Products	21	1,338	1,450	1,231	0.98021	0.09231	1.93487
Furniture and Fixtures Industry	13	1,722	1,754	1,615	0.88141	0.32003	0.65384
Converted Paper and Paperboard Products	8	1,466	1,512	1,526	1.16238	0.06442	2.75173
Printing and Publishing Industries	26	2,851	2,898	2,731	0.83729	0.47891	1.05083
Industrial Chemicals Industry	2	290	298	323	1.12158	0.16872	2.96875
Plastics and Synthetic Fibers Industry	6	3,536	3,566	3,635	0.98970	0.13292	0.91116
Soaps, Cleaners, and Toilet Preparations	2	18	20	17	1.00000	0.36905	5.50000
Paints and Allied Products, Agricultural Chemicals, and Miscellaneous Chemical Products	7	215	227	224	1.03546	0.08060	0.73809
Petroleum Refining and Coal Product Industries	1	116	116	115	1.00000	0.00870	1.00000
Rubber Tires and Tubes and Fabricated Rubber Products	2	93	93	93	1.00000	0.07198	1.00000
Miscellaneous Plastic Products Industry	10	1,042	1,173	1,040	1.29846	0.15175	3.65036
Leather and Leather Products Industries	2	117	123	124	0.61953	0.05000	5.00000
Footwear Cut Stock and Footwear Except Rubber	1	199	199	278	1.00000	0.28417	1.00000
Flat Glass, Glassware, and Glass Products	1	91	91	95	1.00000	0.04211	1.00000
Cement, Structural Clay, Pottery, Plaster	11	257	284	284	0.67987	0.21470	0.88636
Stone Products and Miscellaneous Mineral Products Industries	1	48	61	46	1.50000	0.32609	7.50000
Blast Furnaces and Basic Steel Products Industries	4	6,076	5,993	6,043	2.21838	0.07670	3.12570
Iron and Steel and Nonferrous Foundries	3	493	508	610	1.00931	0.17883	0.72222
Nonferrous Rolling and Drawing/Miscellaneous Primary Metal Products	5	984	1,016	1,020	2.72777	0.14541	3.60000
Musical Instruments, Toys, Sporting Goods, and Other Selected Products	5	137	141	154	0.80306	0.08044	0.60000
Total	301	59,467	61,692	60,592	-	-	-
Average	-	-	-	-	1.08004	0.30372	1.88408

and Miscellaneous Mineral Products Industries. More importantly, the large industries group with the most employers and employees had relatively high values for all three statistics, including Metal Working, Blast Furnaces and Basic Steel Products, and Apparel and Other Textile Products.

(4) The Accuracy Of The Kentucky OTIS Forecasts Varied By Region

The previous analyses considered the ability of an employer or various groups of employers to forecast manpower demand accurately. However, OTIS actually produces and uses regional summaries of net manpower demand by occupational cluster. Manpower requirements are then determined by interfacing manpower supply and demand data by occupation. Consequently, to understand the actual utilization of the subsystem, an assessment of the accuracy of the forecasts of manpower demand by occupation is necessary.

Regional summaries of manpower demand by occupation were compiled from our resurvey data. A sample summary is included in Appendix H. The accuracy of the regional summaries was assessed using the same three statistics used to evaluate employer forecasts. The regional data were computed in the same manner as the data for an individual employer.

- The U Statistic was computed using predicted and actual change for each occupation.
- Statistic I and Statistic II were computed using the totals for all occupations.

Thus, U Statistic allows only net outs among firms for a specific occupation. However, Statistic I and Statistic II allow net outs among employers and among occupations before any calculations are made.

Exhibit XVII, following this page, presents the error statistics for each regional summary. The range and average of each statistic are:

EXHIBIT XVII

Economic Development Administration

KENTUCKY OCCUPATIONAL FORECASTS BY REGION

Region	Number of Employees			Statistics		
	Original	Forecast	Actual	U	I	II
1	387	395	361	1.00542	0.09418	-1.30769
2	2,383	2,877	2,633	0.99588	0.09267	-1.22000
3	5,995	6,129	5,794	1.22450	0.05696	-1.64179
4	5,498	5,924	6,064	0.94112	-0.02309	-0.24735
5	417	455	498	0.94502	-0.08635	-0.53086
6	21,362	21,950	21,495	0.93222	0.02117	3.42105
7	3,445	3,743	3,643	1.09780	0.02745	0.50505
8	1,560	1,681	1,684	0.94828	-0.00178	-0.02419
9	307	307	311	1.00000	-0.01286	-1.00000
10	4,862	4,893	4,793	1.09996	0.02086	-1.44928
14	603	652	740	1.03912	-0.11892	-0.64234
15	12,198	12,691	12,576	0.95930	0.00914	0.30423
Total	59,467	61,692	60,592	-	-	-
Average	-	-	-	1.01572	0.04712	1.02449

- The U Statistic ranges from a low of 0.93222 in region 6 to a high of 1.22450 in region 3. The average of all the regions is 1.01572.

- Statistic I ranges from a low of 0.00178 in region 8 to a high of 0.11892 in region 14. The average value for all regions is 0.04712.

- Statistic II ranges from a low of 0.02419 in region 8 to a high of 3.42105 in region 6. The average value is 1.02449.

The regional performance varies by statistic. The U Statistic was high in all regions. However, considering Statistics I and II, regions 8, 4, and 15 had relatively good forecasts. Conversely, regions 3, 14, and 1 had relatively poor forecasts based on Statistics I and II values.

(5) Combining The Occupation Data Into Clusters Did Not Significantly Improve Forecast Accuracy

As discussed in our earlier analysis of the Oklahoma demand data, the Project Monitoring Committee decided to test the effect on forecast accuracy of combining occupational data into clusters. Six clusters were selected by EDA for testing in four regions and also statewide. The Committee also wanted to test the potential impact of clustering in Kentucky. Since the Kentucky OTIS data are not published and the clusters not available, the Oklahoma clustering scheme was utilized to test the Kentucky data. The occupational clusters drawn up in Kentucky were derived from an analysis of the Oklahoma OTIS Cycle Five Report and the Office of Education instructional program classifications. Once the appropriate DOT codes were selected, the corresponding BLS codes were matched and the clusters developed.

These data were analyzed using the three basic error statistics. Exhibit XVIII, following this page, presents the results of this analysis. In general, forecast accuracy was not improved substantially. As was apparent in the case of the Oklahoma clustering data, the reason for this

EXHIBIT XVIII

Economic Development Administration

EFFECT OF CLUSTERING IN KENTUCKY

Cluster	Region	Number of Employees			Statistics		
		Original	Forecast	Actual	U	I	II
Machine Shop/Machine Tool Operation	3	111	114	95	1.03900	0.20000	1.18750
	4	595	628	604	0.76223	0.39700	2.66600
	6	427	437	517	0.95810	-0.15470	-0.88800
	15	56	224	144	0.65870	0.55500	0.90900
	State	1,890	2,244	2,160	0.92750	0.38890	0.31111
Accounting and Computing	3	116	117	108	1.00990	0.08330	1.12500
	4	175	177	188	1.02460	-0.05850	-0.84615
	6	396	402	392	1.54596	0.02550	2.50000
	15	71	72	81	0.94921	-0.11110	-0.90000
	State	981	1,073	981	4.35400	0.09378	10.00000
Transportation/Truck Driver	3	104	107	97	1.13137	0.10309	1.42850
	4	410	429	321	1.18000	0.33640	1.21348
	6	621	662	632	2.12800	0.04740	2.72700
	15	60	62	71	1.24490	-0.12670	-0.81818
	State	1,614	1,695	1,585	2.32000	0.06940	3.79310
Carpentry	3	75	81	59	1.17890	0.37500	1.37500
	4	24	24	20	1.00000	0.20000	1.00000
	6	506	517	483	0.01766	0.07039	1.47826
	15	203	212	138	1.00498	0.53620	1.13846
	State	965	1,007	876	1.15271	0.14954	-1.47191
Sheet Metal	3	45	47	52	0.82764	-0.09615	-0.71428
	4	76	72	83	1.86547	-0.13253	-1.57142
	6	331	343	388	0.95289	-0.11597	-0.78947
	15	357	406	411	0.00587	-0.01216	-0.09259
	State	1,305	1,464	1,420	0.33100	0.03100	0.38261
Composition, Makeup, and Typesetting/Printing	3*	8	8	8	0.00000	0.00000	0.00000
	4**	--	--	--	--	--	--
	6	287	295	286	9.00000	0.03146	9.00000
	15	55	55	48	1.00000	0.14580	1.00000
	State	363	371	355	2.00000	0.04507	-2.00000

Notes: * Inadequate data

** Resurvey data not available

lack of improvement is that many of the occupational forecasts for manpower demand in a particular cluster were either high or low. Consequently, errors for individual occupations were averaged rather than reduced by offsetting errors.

4. THE INITIAL OTIS DEMAND DATA COLLECTION EFFORT IN KENTUCKY WAS A LARGE UNDERTAKING

The demand data collection effort in Kentucky involved the collection of employer forecasts through a census of all state manufacturing establishments. As already noted, data have been collected recently from 2,175 employers. In addition, ongoing data collection is presently being directed toward more than 8,500 nonmanufacturing employers.

The primary reasons for conducting a statewide census through personal interviews are to:

- Foster a rapport between industry and educational personnel, thereby:
  - Improving response rates
  - Acquiring assistance in the development of accurate occupational forecasts
  - Facilitating counseling, placement, and curriculum modification efforts
  - Enhancing placement prospects for vocational/technical graduates
- Stimulate interagency support and interest by cooperating to collect data

Consequently, an evaluation of this approach must focus on the advantages of increased response rates and employer rapport over the disadvantages of increased costs and management problems.

(1) Increased Rapport With Employers Was Established In Many Instances

Two expected results of the personal interview approach utilized by OTIS in Kentucky were the establishment of rapport with employers and improved data collection. The most recent personal interviews involved over 500 vocational education teachers and state agency personnel, and 1,551 man-days of effort. Thus, approximately one-half of a day, including travel time, was allowed for each interview and information was collected about 2,175 firms. Clearly, this amount of time is adequate to complete a survey instrument and establish communications. Hence, rapport and a basis for future cooperation were probably established with many manufacturing employers.

Nonetheless, the results of our resurvey indicate that the anticipated level of rapport was not realized because the data collection effort was not carried out properly in some instances and because some employers did not agree with the survey aims. For example, of the employers resurveyed, approximately 25 percent did not remember completing the survey. After discussing the survey with the resurvey interviewer:

- Fifteen percent of the employers stated that the personal visits involved only presenting the survey document and collecting it later on.
- Twenty-five percent of the employers said the survey instrument was received in the mail with a self-addressed envelop and no instructions.
- Fifteen percent of the employers said the survey instrument was presented and collected by vocational education students, but that no instructions were received.

In addition, some employers stated that they (1) had prepared too many forms and that OTIS forms duplicated the ES documents, (2) believed the training of vocational education graduates was inadequate, and (3) could not hire vocational education graduates due to low turnover or restrictions on outside hiring. Therefore, in many instances, the survey did not result in the expected employer rapport. More importantly, the lack of both personal contact and instructions to accompany the questionnaires hampered the data collection effort in several instances.

(2) Many Respondents In Kentucky Made No-Change Forecasts

Exhibit XIX, following this page, presents a summary of the forecasts received in Kentucky. Over 50 percent of the employers participating in the survey made no-change forecasts. The percentage of no-change forecasts ranged from 45 percent in regions 12 and 15 to 73 percent in region 9. Similar percentages were noted in our resurvey.

Clearly, many of these forecasts reflect accurate employer judgments of expansion demand, e.g., most of the correct forecasts were no-change forecasts. However, our employer interviews indicate several other important reasons for the high incidence of no-change forecasts. For example, some employers did not:

- Receive instructions to make a forecast
- Understand they were forecasting
- Make any forecast at all

Consequently [illegible] that many of the forecasts reported as no-change were [illegible]-forecasts. Several of the employers interviewed [illegible] that they had made no forecasts, but the printouts indicated no-change forecasts. More importantly, some employers kept copies of their original documents, verifying that, in fact, no forecasts were made. In our judgment, the high incidence of no-change forecasts is attributable not only to misunderstanding of instructions and/or an unwillingness to forecast, but also to counting no forecasts as no-change forecasts.

EXHIBIT XIX

Economic Development Administration

SUMMARY OF EMPLOYER FORECAST RESPONSES: KENTUCKY

Area	Total Number of Surveys	Respondents Projecting No Change*		Respondents Projecting Increase		Respondents Projecting Increase in First Year and No Change in Second Year		Respondents Projecting Increase in First and Second Year	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
Purchase	123	62	50	61	50	40	33	21	17
Pennyrile	131	70	53	61	47	37	28	24	18
Green River	179	115	64	64	36	26	15	38	21
Barren River	164	89	54	75	46	28	17	47	29
Lincoln Trail	89	48	54	41	46	20	22	21	24
Jefferson	570	380	67	190	33	86	15	104	18
Northern Kentucky	147	83	56	64	44	29	20	35	24
Buffalo Trace	26	17	65	9	35	6	23	3	12
Gateway	22	16	73	6	27	1	5	5	23
Fivco	60	31	52	29	48	16	27	13	22
Big Sandy	31	15	48	16	52	7	23	9	29
Kentucky River	31	14	45	17	55	8	26	9	29
Cumberland Valley	110	53	48	57	52	25	23	32	29
Lake Cumberland	134	70	52	64	48	30	22	34	25
Bluegrass	294	131	45	163	55	69	23	94	32
Total	2,111	1,194	57	917	43	428	20	489	23

Note: * Declines are included in No Change; very few were reported.

(3) Delays In Employer Submissions Shortened Forecast Periods

Originally, OTIS demand data were to be gathered in June, 1972. Employers were asked to forecast their manpower needs for May 15, 1973, and May 15, 1974, so that one-year and two-year forecasts would be available. Unfortunately, a substantial amount of the data were not submitted promptly.

Exhibit XX, following this page, presents a distribution of the months during which data were submitted and received by OTIS. This exhibit shows most of the data being collected in September, October, and November, 1972, but also that data were still being collected in April, 1973. Consequently, the forecasts were probably submitted shortly after preparation and, of the 2,214 respondents:

- 247 employers, or slightly over 11 percent, made a forecast for 10 to 12 months.
- 1,856 employers, or nearly 84 percent, made a forecast for seven to nine months.
- 111 employers, or 5 percent, made forecasts for six months or less.

This distribution of responses can be described as follows:

- The mean forecast period was 8.53 months.
- The modal forecast period was nine months.
- The median forecast period was nine months.

5. OTIS DEMAND DATA AS PRESENTLY CALCULATED DO NOT REPRESENT TOTAL MANPOWER DEMAND

Our analysis indicates that the demand data compiled in both states do not represent total manpower demand. The principal causes of incomplete data involved the current status of the system in Kentucky and the instruments for collecting demand data in Oklahoma.

EXHIBIT XX

Economic Development Administration

DEMAND DATA SUBMISSION DATES
BY REGION: KENTUCKY

Region	Monthly Survey Responses Received											Total
	06/72	07/72	08/72	09/72	10/72	11/72	12/72	01/73	02/73	03/73	04/73	
Purchase	--	--	--	106	--	18	--	--	--	2	--	126
Pennyrile	130	--	--	--	--	--	--	--	--	--	--	130
Green River	--	--	--	186	--	15	--	--	--	2	--	203
Barren River	--	--	1	146	--	23	--	--	--	1	--	171
Lincoln Trail	--	--	--	--	77	9	--	1	--	--	--	87
Jefferson	--	--	--	50	219	269	31	--	--	--	--	569
Northern Kentucky	--	--	--	126	--	21	--	--	--	14	9	170
Buffalo Trace	--	--	--	22	2	5	--	3	--	--	--	32
Gateway	--	--	--	2	9	2	--	4	--	--	--	17
Fivco	--	--	--	17	37	7	7	--	--	--	--	68
Big Sandy	--	--	--	30	--	--	--	--	--	--	--	30
Kentucky River	--	--	22	5	--	4	--	--	--	--	--	31
Cumberland Valley	94	--	--	--	--	16	--	--	--	--	--	110
Lake Cumberland	--	--	--	122	--	14	--	--	--	--	--	136
Bluegrass	--	--	--	259	--	38	--	13	17	7	--	334
Total	224	--	23	1,071	344	441	38	21	17	26	9	2,214

(1) OTIS Kentucky Was Unable To Incorporate Replacement Demand Data Into The Total Demand Data System Since Attrition Rates Were Unavailable

Total demand for manpower equals the total number of job openings that are available or are expected to be available over the course of the forecast period. In other words, total demand is comprised both of expansion demand and of replacement demand.

- Expansion Demand refers to changes in the number of jobs due to expansion or reduction in manpower needs. Thus, expansion demand is usually positive in expanding industries, zero in static industries, and negative in declining industries.
- Replacement Demand refers to openings created by normal attrition in the work force due to deaths and retirement.

The OTIS survey instruments utilized in Kentucky collected projections of the total number of positions expected to be available as of the forecast date. These forecast totals are compared to existing employment levels to obtain the net change in positions available. Thus, OTIS Kentucky collects only expansion demand data.

Kentucky was not able to incorporate replacement demand into total demand in the original system design because attrition data were not available.[1] However, combined death and retirement rates by occupation have been calculated recently from the 1970 decennial census data. The weighted average rates for the total work force in Kentucky are approximately 4 percent. It is reasonable to assume that the calculated death and retirement rates are representative of the manufacturing work force in Kentucky. Hence, these rates can be applied to the number of employees included in the OTIS survey in Kentucky to determine approximate replacement demand. The following illustrates this calculation:

---

[1] These data are now available and are being incorporated into OTIS.

- The total work force included in the OTIS Kentucky survey was 225,293. The survey provided an overall projection of 5,200 new positions.
- Based on the calculated death and retirement rates shown above, the total replacement demand is about 9,000 positions.
- Since total demand is computed by adding OTIS expansion and replacement demand figures, the total demand is about 14,255 in Kentucky for manufacturing employers.

Finally, the result of a comparison of the expansion demand reported by OTIS and the probable total demand shows that OTIS Kentucky reports only about 37 percent of the total.

(2) The OTIS Demand Survey In Oklahoma Captures Data For Vocational Education Training Occupations

Oklahoma utilizes a series of 11 forms in their demand survey. These forms were developed for particular industries and contain approximately 280 DOT codes. The occupations selected represent the areas in which vocational training is conducted, i.e., low-skill or menial occupations plus highly trained professional classifications were excluded purposely. Unfortunately, these limitations preclude collection of total expansion demand.

The Oklahoma survey included 2,633 employers of nearly 375,000 people. Survey responses were received from 1,865 employers representing approximately 312,000 employees. An analysis of these responses indicates that over 30 percent of the work force of the respondents were employed in occupations not included on the form. As noted earlier, our resurvey substantiates this percentage. Thus, demand data cannot be assigned to these occupations and they are, therefore, excluded from OTIS totals and the cycle reports.

MANPOWER SUPPLY SUBSYSTEM

This section presents our findings regarding the manpower supply subsystem. Specifically, the following characteristics of the subsystem are discussed:

- The sources of information concerning manpower supply, including the student accounting system
- The information provided by the student accounting system
- The comprehensiveness of manpower supply data

1. THE SOURCES OF MANPOWER SUPPLY INFORMATION IN OKLAHOMA AND KENTUCKY ARE SIMILAR

Oklahoma collects manpower supply information from five sources. Kentucky plans to obtain supply data from similar sources. In both states, the student accounting system is the primary source of data on individuals with vocational training. However, the information provided by this system differs substantially in each state.

(1) Implementation Of The Manpower Supply Subsystem Has Been Approached Similarly In Each State

In Oklahoma, information concerning statewide manpower supply is obtained from five sources:

- The Oklahoma State Department of Vocational and Technical Education is the principal source of supply data, including data concerning:
  - High school vocational program graduates
  - Post high school vocational program graduates
  - Adult vocational program graduates
  - Manpower Development and Training Act (MDTA) graduates

- The Governor's Comprehensive Manpower Planning Staff provides supply data on the number of graduates of federal training programs not associated with the State Department of Vocational and Technical Education.
  - Bureau of Indian Affairs
  - Concentrated Employment Program (CEP)
  - Department of Corrections
  - Migrant Education
  - Work Incentive Program (WIN)
  - Opportunities Industrialization Center (OIC)
  - Rehabilitative Services
  - Tulsa Urban League
- The State Accrediting Agency provides information on the number of private school graduates based on license applications required annually by state law.
- OESC provides information on the number of qualified registrants available to fill jobs.
- The Oklahoma Board of Nurse Registration and Nurse Education, working jointly with the State Department of Vocational and Technical Education, provides supply information on the number of nurses available for employment.

Information for vocational education and MDTA program graduates is reported automatically in Oklahoma through the student accounting system, as described below. Supply data for the last four categories are reported by special arrangement with the responsible agency. Additionally, special studies are conducted to assess the manpower supply for each of the appropriate areas covered in the OTIS cycle reports.

Currently, the Kentucky system collects supply information primarily from state-funded vocational/technical programs, from DOL apprenticeship programs, and from ES registrants. However, future plans call for the inclusion of additional sources of manpower supply similar to those utilized by OTIS Oklahoma.

(2) The Information Provided By The Student Accounting Systems In Oklahoma And Kentucky Differs Substantially

As discussed in Chapter II, the student accounting system is the primary mechanism for collecting and processing manpower supply data in both Oklahoma and Kentucky. Exhibit XXI, following this page, provides a comparative overview of the Oklahoma and Kentucky systems. In addition, the Oklahoma portion of the exhibit shows the interface between student accounting data and other supply sources discussed in the previous section.

The student accounting system collects the following data:

- Enrollment data by student and course to establish a record
- Dropout/transfer data to update existing records
- Termination data to modify the existing data base. These data are utilized in the supply subsystem and are being utilized in the student follow-up subsystem.

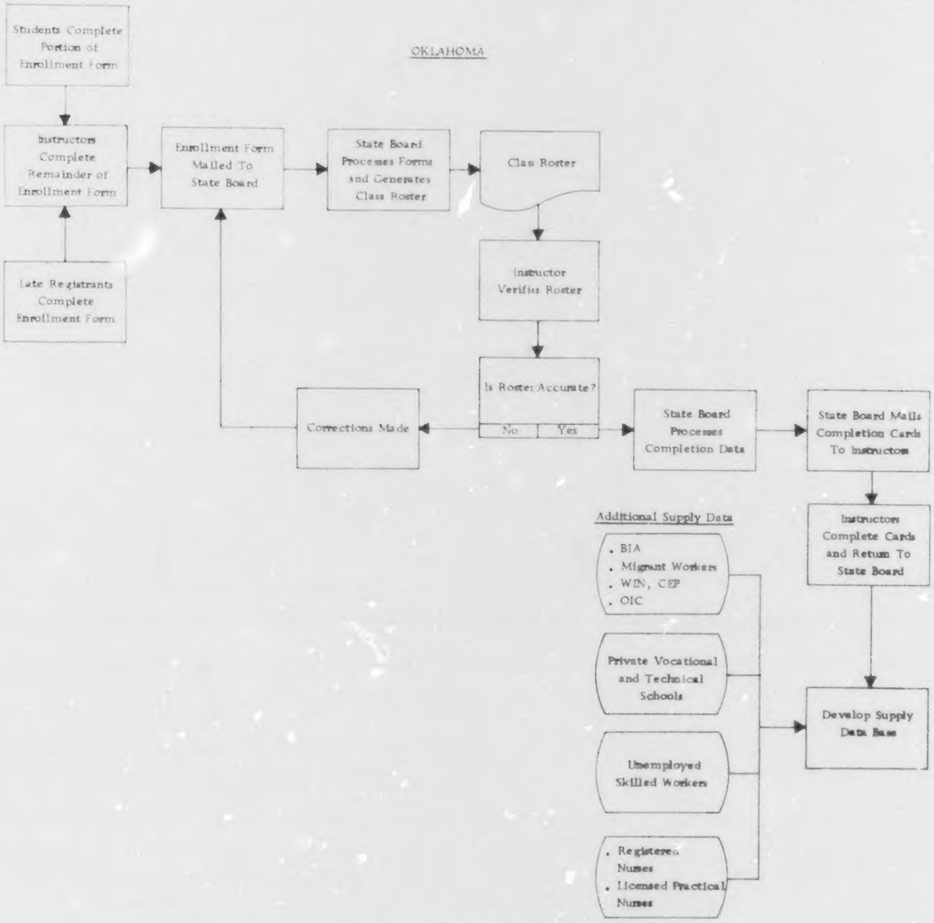
The scope of information required for each state system differs substantially. In addition to the collection of data for tracking enrollees, transfers, and graduates, the Kentucky student accounting system will collect a broader scope of data than the subsystem in Oklahoma. The major differences in data collection are outlined below:

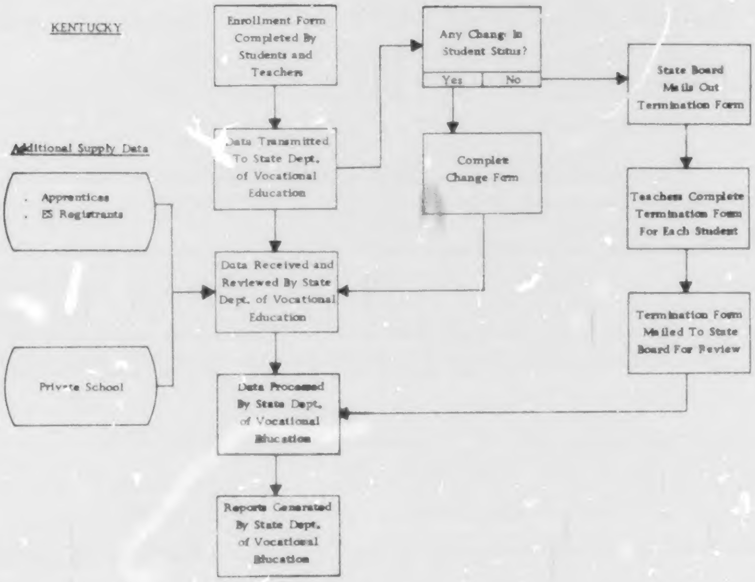
- Oklahoma collects the following four categories of disadvantaged characteristics data:
    - Not disadvantaged
    - Member of a family in which the yearly income is less than $3,000
    - Academically disadvantaged and needs special programs or services
    - Both economically and academically disadvantaged

EXHIBIT XXI

Economic Development Administration

OTIS STUDENT ACCOUNTING SYSTEM
DATA COLLECTION PROCEDURES


OKLAHOMA
Students Complete Portion of Enrollment Form
Instructors Complete Remainder of Enrollment Form
Late Registrants Complete Enrollment Form
Enrollment Form Mailed To State Board
State Board Processes Forms and Generates Class Roster
Class Roster
Instructor Verifies Roster
Is Roster Accurate?
No
Yes
Corrections Made
State Board Processes Completion Data
State Board Mails Completion Cards To Instructors
Instructors Complete Cards and Return To State Board
Develop Supply Data Base
Additional Supply Data
. BIA
. Migrant Workers
. WIN, CEP
. OIC
Private Vocational and Technical Schools
Unemployed Skilled Workers
. Registered Nurses
. Licensed Practical Nurses


KENTUCKY
Enrollment Form Completed By Students and Teachers
Any Change In Student Status?
Yes
No
State Board Mails Out Termination Form
Data Transmitted To State Dept. of Vocational Education
Complete Change Form
Teachers Complete Termination Form For Each Student
Additional Supply Data
. Apprentices
. ES Registrants
Data Received and Reviewed By State Dept. of Vocational Education
Termination Form Mailed To State Board For Review
Private School
Data Processed By State Dept. of Vocational Education
Reports Generated By State Dept. of Vocational Education

In Kentucky, 10 categories of disadvantaged data are collected:

- Not disadvantaged
- Academic
- Socioeconomic
- Aged
- Correctional institute inmate
- Cultural or linguistic isolation
- Dropout potential
- Correctional institute parolee
- Juvenile delinquent
- Migrant
- Other

. Oklahoma collects information concerning a student's aspirations in the occupational training area. In contrast, the Kentucky system collects data about a student's educational goals in the following categories:

- Obtain GED
- Complete high school
- Continue education in an on-the-job training program
- Enter military service
- Continue study in vocational, technical, trade, or business school
- Attend community college (two-year program)
- Complete college for bachelor's degree
- Study beyond bachelor's degree
- Other

. The Oklahoma termination card reflects only the following information, supplied by the teacher:

- Complete the training program and (1) graduate, or (2) leave school without graduating
- Complete the training program and remain in the school in other course work

- Complete this year in the training program and plan to continue in the program

- Drop out of the training program but continue in school

- Transfer to another school

- Dropped out of school and is employed full time in the field for which he/she was training

- Dropout or transfer and status is not known, or is deceased

- Was not in program this year

The Kentucky system also tabulates terminations but, in addition, collects a substantial degree of evaluative data in three areas:

- Degree of accomplishment rated by the teachers as:
  - Excellent
  - Good
  - Average
  - Fair
  - Poor

- Type of termination

- Reason for dropping out, according to the teacher

Additionally, Kentucky plans to develop a more extensive linkage between the student accounting and follow-up systems, e.g., to relate evaluative data to subsequent success. This capability will provide for the eventual development of process and impact evaluation strategies.

2. OTIS OKLAHOMA SUPPLY TOTALS ARE COMPRISED PRIMARILY OF GRADUATES FROM FORMAL TRAINING PROGRAMS AND EMPLOYMENT SERVICE REGISTRANTS

In any discussion of manpower supply, job market entrants usually include individuals from the following sources:

- Graduates of formal training programs such as vocational education programs and federal work/training programs
- Individuals formerly outside the labor force:
    - Housewives desiring to reenter the labor force
    - Handicapped workers
    - Returning veterans
- People entering the labor force through immigration or net in-migration
- Individuals formerly working in other occupations, i.e., entering the labor pool through nonvocational education and upward mobility

An analysis of the operational supply subsystem in OTIS Oklahoma indicates that OTIS manpower supply totals are comprised principally of graduates of formal vocational training programs and registrants with OESC. Exhibit XXII, following this page, presents the composition of manpower supply reported in the OTIS Oklahoma Cycle Five Report by source and category. Of the 25,769 individuals, 11,561, or nearly 45 percent, were OESC registrants and 10,592, or over 41 percent, were graduates of vocational education programs. The remaining 14 percent were graduates of federal training programs and private schools.

(1) Three Major Sources Of Job Market Entrants Are Not Included In OTIS Supply Totals

A comparison of the Oklahoma sources of supply data indicates that, with the exception of company-trained individuals, persons receiving formal vocational training appear to be adequately covered. However, three categories of labor supply entering the work force are not considered directly:[1]

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[1] This problem has been recognized and procedures are being developed to collect additional supply data.

EXHIBIT XXII

Economic Development Administration

COMPOSITION AND SOURCE OF
OTIS OKLAHOMA SUPPLY DATA

Source	Supply Category	Total Supply		Percentage of Total Supply	
Oklahoma State Department of Vocational and Technical Education	High School Vocational Program Graduates	5,707		22.1	
	Post High School Vocational Program Graduates	1,601		6.2	
	Adult Vocational Program Graduates	3,285		12.7	
	Total Voc-Ed Supply		10,593		41.1
	MDTA Graduates	1,158		4.5	
Governor's Comprehensive Manpower Staff	Other Federal Programs, e.g., CEP, WIN, OIC	151		0.6	
	Total Federal Program Supply		1,309		5.1
State Accrediting Agency	Private School Graduates		2,306		8.9
Oklahoma Employment Security Commission			11,561		44.9
	TOTAL SUPPLY		25,769		100.0

- Outside the labor force
- Other occupations/nonvocational training
- Immigration

Quantifying the extent of the omissions, i.e., the number of individuals not included in supply, is extremely difficult. However, the results of numerous studies indicate that the number of people entering the job market from nonvocational schools and other occupations, i.e., interoccupational mobility, is considerable.[1] For example, many workers in Oklahoma entered the labor force from institutions that are not included in the sources of supply for the current OTIS report, e.g.:

- High school
- Junior high school
- Companies
- Armed forces
- Correspondence schools

In addition, the OTIS supply component does not consider individuals entering the labor force with one to three years of college. However, recent studies in Oklahoma indicate that many of these individuals enter the job market in the area in which they received vocational training.

Undoubtedly, some of the above persons omitted currently from OTIS supply data are included in the OESC registrants, which comprise approximately 50 percent of manpower supply. However, despite the relatively high Employment Service penetration rates in Oklahoma, it is likely that many workers are not included in the OESC totals. Thus, the published OTIS supply figures understate supply.

The manpower supply subsystem in OTIS Kentucky is presently under development by the state professional staff. To date, little formal documentation of the supply component has been developed. Some MDTA and apprenticeship program data have been collected. Generally, subsystem design appears to be similar to that of the OTIS Oklahoma subsystem. For example, the Kentucky system designers plan to utilize a supply component based on enrollments and graduations of:

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[1] U.S. Department of Labor, Manpower Administration, Office of Manpower, Automation, and Training, Formal Occupational Training Adult Workers, Manpower/Automation Research Monograph No. 2, Washington, D.C.; U.S. Government Printing Office, 1964; and Young, Robert C., Manpower Information For Vocational Education Planning, The Center For Vocational And Technical Education, Ohio State University, Columbus, Ohio, November, 1969; p. 102.

- Public vocational schools
- Technical institutes
- Community and junior colleges
- Private vocational and business schools
- Federal training programs

In addition to these data sources, the staff plans to collect in-migration data from Employment Security offices throughout the state. The methodology for collecting, integrating, and utilizing the collected data has not yet been established for review and analysis.

(2) Manpower Supply Forecasts Are Comprised Of A Mix Of Estimated And Current Data

The supply forecasts contained in the OTIS Oklahoma reports are developed through the utilization of a variety of methods.

- Adjustments are made based on formulae developed from the student accounting system and follow-up data. The adjustments are detailed in Appendix I.

- Private school graduate data are not adjusted. The previous year's graduation level is used as the forecast for the current year, i.e., no forecast is made.

- Federal program graduate data are not adjusted. All graduates are assumed to be job-ready.

- Employment Service registrants are not forecasted. Availability and eligibility determinations are made by OESC personnel based on registrant files.

Thus, the OTIS supply forecast is comprised of a combination of OESC current registrant data and other adjusted and unadjusted supply estimates.

INTERFACE, STUDENT FOLLOW-UP, COST, AND EDUCATIONAL RESOURCES SUBSYSTEMS

This section presents the results of analyses of the interface, student follow-up, cost, and educational resources subsystems. Specifically, the topics discussed include the:

- Development and use of the interface statistic
- Differences in the scope of the student follow-up systems in Oklahoma and Kentucky
- Uses and potential of the cost and educational resources subsystems

1. THE INTERFACE STATISTIC SHOULD BE USED WITH CAUTION

The interface statistic is the principal output produced by OTIS. Exhibit III, following page 6, displays a sample page of output from the OTIS Oklahoma Cycle Five Report. The interface statistic is determined by comparing manpower supply for each occupation (DOT code) within a selected educational program cluster with forecasts of manpower demand for the same occupations. Thus, the interface statistic represents the net manpower requirements for a specific vocation training program cluster in a given planning area and on a cumulative basis statewide.[1]

As noted earlier, some of the OTIS forecasts of manpower demand are inaccurate and additional sources of manpower supply are required. However, even if manpower demand data were accurate and manpower supply data complete, the interface statistic should be used with caution. Some of the reasons why this statistic could be misleading are described below.[2]

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[1] See above, pp. 6-7.

[2] The OTIS Cycle Five Report also notes that the manpower supply and demand tables should be viewed dynamically, especially at the regional levels where changes in the plans of a single firm could significantly influence demand in a given occupation.

- Manpower requirements data are aggregated statewide and by region. However, commutation patterns can affect the results. For example, an excess of supply (people) for a particular occupation statewide or in a particular region may be offset by workers commuting to another state or region, e.g., nearly 36,000 more Kentucky residents commute to Ohio than Ohio residents commute to Kentucky.[1/]

- In- and out-migration may alter the net manpower requirement projections over the course of the forecast period by decreasing or increasing manpower supply.

- The jobs included in demand are not strictly comparable with the occupations listed in supply. For example, it is unlikely that vocational education enrollees in police science will be applying upon graduation for jobs as sheriffs.

- Not all of the graduates of manpower training programs are competent to perform the jobs for which they are trained due to improper training and/or attitudinal problems. Consequently, supply for a given occupation may be overstated.

- Supply of manpower may not be available concurrently with demand. Therefore, imbalances between demand and supply may occur over the course of the forecast period.

- OTIS supply counts all persons available for the labor market. However, in Oklahoma, OTIS demand includes only demand for selected occupations. Therefore, net demand is understated because many people in supply can qualify for jobs not included in the survey.

- Many trained individuals can and do qualify for jobs outside the scope of their training. For example, many workers have multiple skills and demonstrate a high degree of occupational mobility.[2/] Thus, supply for a particular occupation can change with personnel shifts.

[1/] Community Patterns of Kentucky Counties, Kentucky Department of Commerce

[2/] Young, Robert C., Manpower Information For Vocational Education Planning, The Center For Vocational And Technical Education, Ohio State University, Columbus, Ohio, November, 1969.

2. THE OPERATION AND UTILIZATION OF THE STUDENT FOLLOW-UP SUBSYSTEM DIFFERS SUBSTANTIALLY IN EACH STATE

The purpose of the student follow-up system in both states is to track program participants, thereby establishing individual training and career linkages. However, the method of conducting the follow-up surveys varies, and, more importantly, the use of the surveys in Kentucky and Oklahoma differs substantially.

Kentucky uses a direct student follow-up technique as part of the student accounting system discussed previously. This approach consists of a periodic mailing to a percentage of former students. The form is completed by the terminee and returned to the state for analysis. Experience to date indicates:

- Of the 10,806 persons contacted in the pilot study, 48 percent or 5,189 had responded after three mailings.
- A follow-up of 50 students was made to determine nonrespondent information and/or bias.
- The collection data were utilized to prepare reports of the following types:
  - Current work-related activity by program area
  - Job-related training program by program area
  - Frequency of the use of learned skill by program area
  - Wages earned by vocational program service area

In contrast, Oklahoma follows up students by contacting the classroom instructor. Questionnaires are mailed to the former instructor of a program. The instructor is given a follow-up card for each student. Through his or her local knowledge and contacts, the teacher completes the follow-up card. The card contains a list of 10 possible post-training activities. The data produced were used in the development of Supplement V to the OTIS Cycle Three Report.[1] Individual data are not collected for MDTA program students or special school students. In addition, the Oklahoma State Department of Vocational and Technical

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[1] OTIS Cycle III Report, Supplement V, a follow-up study of Oklahoma vocational and technical education graduates and dropouts; 1968 - 1969 and 1969 - 1970, Division of Research, Planning, and Evaluation, Oklahoma State Department of Vocational and Technical Education.

Education conducts a parallel follow-up survey of students, stratified by occupational objectives, to validate the teachers' follow-up information.

Thus, follow-up information obtained in Kentucky is much more comprehensive than that collected in Oklahoma. More importantly, Kentucky plans to develop a more extensive linkage between the student accounting and follow-up subsystems. The purposes of this linkage are:

- To develop indices for evaluating the training process in terms of the success or failure of program graduates
- To collect data to ensure the relevancy of training to the working environment encountered by graduates

Evaluation of the educational process requires assessment of program impact. Accordingly, the data collection methodology of the student follow-up subsystem can be utilized directly to formulate a comprehensive evaluation strategy that analyzes the inherent relationships among:

- Student graduate success and program resources requirements
- Student graduate success and program content
- Student graduate success and disadvantaged program considerations

The resulting evaluation would provide key societal data for cost-benefit analysis and resource allocation decisions. The data provided by these subsystems are also necessary to support (1) placement and job development, (2) employability development and vocational counseling, and (3) planning and development of training program curricula.

3. THE OBJECTIVES OF THE KENTUCKY COST AND EDUCATIONAL RESOURCES SUBSYSTEMS APPEAR TO BE SIMILAR

OTIS Kentucky conceptual model contains both a cost subsystem and an educational resources subsystem. Our analysis of these two components indicates that these objectives are similar.

In concept, the cost subsystem was designed to produce two outputs:

- An analysis of program costs vs the benefits accrued to society and students. This analysis is to be based, primarily, on data collected by the follow-up system and financial data collected by the State Department of Vocational and Technical Education.
- A cost-benefit report presented to the state director, state board, local boards, executive secretary for CAMPS, the Governor, and the state legislature. The basis of this report is the cost-benefit analysis.

According to the OTIS Final Report, the cost subsystem was to be formulated "to help determine program mix, i.e., the proportionate distribution of resources among occupational program service areas."[1/]

An educational resource inventory data file has been started in Kentucky. Principal data include:

- Buildings, including schools, classrooms, shops, laboratories, and other structures for educational instruction and administrative purposes
- Equipment, including instructional equipment (i.e., desks, machines, typewriters car engines, shop tools, etc.) and maintenance equipment
- Personnel, consisting of an inventory of teachers, administrators, maintenance personnel, and support staff

In addition, plans are being formulated to add community characteristics, industrial and economic analysis, land-use, and community services data. These elements are not part of the OTIS system developed for Kentucky.

The objective of the educational resources subsystem is to provide data to program planners involved in making resource reallocation decisions that reflect factual considerations of currently available facilities, equipment, and personnel. The system will relate requisite resources to specific programs to be undertaken. Further, these resources can be compared to the specific

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[1/] Braden, Paul V., et al, Occupational Training Information System (OTIS) Final Report, Research Foundation, Oklahoma State University, Stillwater, Oklahoma, 1970; p. 44.

goals and objectives of the planned program. Subsequently, the analyses supported by this subsystem may be combined with evaluations of program impact based on student follow-up data to facilitate more extensive planning and evaluation.

This original objective and uses of these subsystems appear to be identical. Thus, in our judgment, the educational resources and the cost subsystems in Kentucky could be combined into one comprehensive system, thereby providing users with both resources and cost data so that resource allocations can be made effectively.

OVERALL SYSTEM AND SYSTEM IMPACT

Our findings regarding the overall OTIS system and its impact and replicability are presented in this section. Specifically, the following topics are discussed.

- The similarities between OTIS information needs and the needs of a typical labor market information (LMI) system
- The extent to which OTIS output is utilized for state and local planning
- OTIS development and operating costs
- The cost of replicating OTIS in other states

1. OTIS IS A SPECIAL-PURPOSE LMI SYSTEM

As originally conceived, OTIS was a self-contained system providing comprehensive information for state vocational education and manpower planning. However, much of the information gathered, processed, and reported by OTIS is similar to the information processed by the Employment Service. Exhibit XXIII, following this page, lists 28 broad information needs that should be met by an LMI system in a large metropolitan area and compares these data with information processed by OTIS. The OTIS system incorporates only one-half of the needs specified for the LMI system. Consequently, OTIS can be viewed as a special-purpose LMI system, i.e., as part of a much larger manpower system.

EXHIBIT XXIII(1)

Economic Development Administration

COMPARISON OF LMI/OTIS
INFORMATION NEEDS

LMI Information Needs	OTIS			Note
	Collected	Processed	Output	
1. Locational and Identifying Information By Establishment	For Survey	Yes	In Kentucky only	Confidentiality maintained in Oklahoma; privileged in Kentucky
2. Establishment Employment By Industry	Yes	Yes	No	Could be produced from data collected, but not presently in cycle reports
3. Establishment Employment By Occupation	Yes	Not printed in cycle reports	In Kentucky, completed forms are made available at area voc-ed schools.	Current status not included in cycle report
4. Establishment Potential for Employment of Special Worker Groups By Occupation	Yes	No	Special needs data collected but not formally produced	Critical data are available after editing
5. Establishment Labor Demand By Occupation	Yes	Yes	One-year New Job Projection	
6. Total Employment Distribution By Occupation	Yes	No	No	OTIS provides forecast of expansion and, in Oklahoma, replacement demand. Total employment per se is not printed in cycle reports.
7. Characteristics of the "Typical Job" By Occupation	No	No	No	Output of View System in Oklahoma and Kentucky
8. Indicators of Labor Supply By Occupation	Yes	Yes	Projected supply	To be interfaced with demand
9. Characteristics of "Worker Customarily Hired" in the Occupation	No	No	No	These data are available from various sources but are not included in OTIS, e.g., View System in Oklahoma
10. Indicators of Labor Demand/Supply Relationships By Occupation	No	Yes	Net surplus, by industry, of occupations	Produced by interface system
11. Anticipated Short-Term Total Labor Demand By Occupation	Two-year projection collected in Oklahoma; one- and two-years, in Kentucky	Yes	Annual projection included in cycle report	Two-year projection is halved in Oklahoma for one-year data.

EXHIBIT XXIII(2)

LMI Information Needs	OTIS			Note
	Collected	Processed	Output	
12. Anticipated Longer-Term Total Labor Demand By Occupation	Long-term forecast of four years: Oklahoma	Yes	Only short-term annual projection included in cycle report	Oklahoma collects two- and four-year data; Kentucky collects one- and two-year data.
13. Probable Changes in Characteristics of "Typical Job" By Occupation	No	No	No	At this time, job analysis is not part of either operating OTIS system.
14. Probable Changes in Characteristics of "Worker Customarily Hired" in the Occupation	No	No	No	Included in View System in Oklahoma and Kentucky
15. Current Annual Estimates of the Population By Specified Area	No	No	No	Some demographic data collected through Student Accounting System
16. Current Annual and Quarterly Estimates of Labor Force By Specified Area	Partial	Annual projection only	Supply estimates on an annual basis	Supply estimates, however, are not based on total labor force estimates or projections.
17. Indicators of Manpower Service Needs By Specified Area	Partial	Through Student Accounting System	Disadvantaged students data	Underdeveloped Human Resources System is conceived to produce some of the indicators included in this component.
18. Community Employment Trends	Yes	Yes	County, area, and state projections	OTIS Oklahoma has six-year record.
19. Community Development and Economic Outlook	Partial	Economic trend data used to update Oklahoma projections	Demand projection adjustments	Economic analysis not part of Kentucky projections
20. Longer-Term Employment Projections By Industry (Including Assumptions)	Yes			See item 12 above; long-term projections are available from DOL/ES
21. Community Wage Rates	No	No	Wage rates are not included in present OTIS cycle reports.	View System utilizes wage data in Kentucky and Oklahoma provided by the Employment Service
22. Training Opportunities By Occupation	No	No	Yes	Plans are being developed in Kentucky to prepare training list as part of KITES; included in View System in Oklahoma
23. Apprenticeship Opportunities	No	No	No	Included in View data in Oklahoma and Kentucky
24. Licenses, Credentials, Certificates	No	No	No	Included in View data in Oklahoma and Kentucky

EXHIBIT XXIII(3)

LMI Information Needs	OTIS			Note
	Collected	Processed	Output	
25. Employment-Related Supportive Services	No	No	No	
26. Unions	No	No	No	
27. Hiring Channels	No	No	No	
28. Community Commuting Patterns and Transportation Facilities	No	No	No	

BEST COPY AVAILABLE

Source: Thal-Larsen, Margaret, Requirements and Design of a Labor Market Information System for a Large Metropolitan Area, University of California, Berkeley, November, 1972.

2. OTIS DATA ARE UTILIZED IN THE PLANNING PROCESS BY BOTH OKLAHOMA AND KENTUCKY

The principal objective of OTIS is to provide the regional and state planning and operating information necessary to formulate educational, manpower, and economic development plans and policies. Our analysis indicates that OTIS data are utilized in the planning process by both Oklahoma and Kentucky.

(1) OTIS Output Influences Directly The Oklahoma State Vocational Education Plan

Prior to the development of OTIS, state officials believed that adequate planning data were not available and/or that existing data were:

- Aggregated only at the national and state levels
- Not easily disaggregated
- Limited to certain uses because of confidentiality constraints

More importantly, local level occupational data were not expected to be available soon. Thus, OTIS was developed to produce regional aggregations of demand and supply data by occupation and to incorporate these data into a comprehensive planning process. Therefore, OTIS has been widely accepted because it gathered local data and produced local regional aggregations of supply and demand by occupation. Additionally, in the judgment of users, OTIS produces a straightforward set of data.

The data produced by OTIS are utilized in the formulation of the Oklahoma Vocational Education Plan. For example, provisions of the plan require that:

- "In allocating funds among local educational agencies, the State Board shall give due consideration to information regarding current and projected manpower needs and job opportunities on the local, state, and national levels."[1/]
- "The State Board shall give particular consideration to those local educational agencies whose proposed vocational education programs are best designed to:

[1/] Oklahoma State Plan

- Fulfill current or projected manpower needs in existing occupations at the local level by preparing students for current or projected job opportunities in such occupations, or

- Fulfill new and emerging manpower needs at the local, state, and national levels by preparing students for new and emerging job opportunities at such levels."[1]

More importantly, the Division of Vocational and Technical Education has been directed to establish only those new programs that are able to demonstrate a high level of employment demand. Consequently, the Division has developed a planning process incorporating this mandate.

Exhibit XXIV, following this page, presents an overview of the Oklahoma vocational education planning process. A formula has been developed to weight the various criteria considered in funding new programs. The criteria and weights comprising the formula are:

- Manpower needs--weight 5
- Vocational education needs--weight 5
- Relative ability to pay--weight 3
- Excess costs--weight 2

The weights are based on data obtained from the student accounting system. However, the emphasis on manpower demand is clear and these data are obtained from OTIS.

(2) Kentucky Is Incorporating OTIS Data Into The Planning Process

Kentucky also plans to integrate OTIS data into the state and local planning process. To date, OTIS has had limited impact on the state educational planning system because the system is new and interface output has not been produced. However, the results of our interviews indicate that Kentucky plans to use data produced by OTIS for applications similar to those in Oklahoma. Currently, plans are being developed to build on

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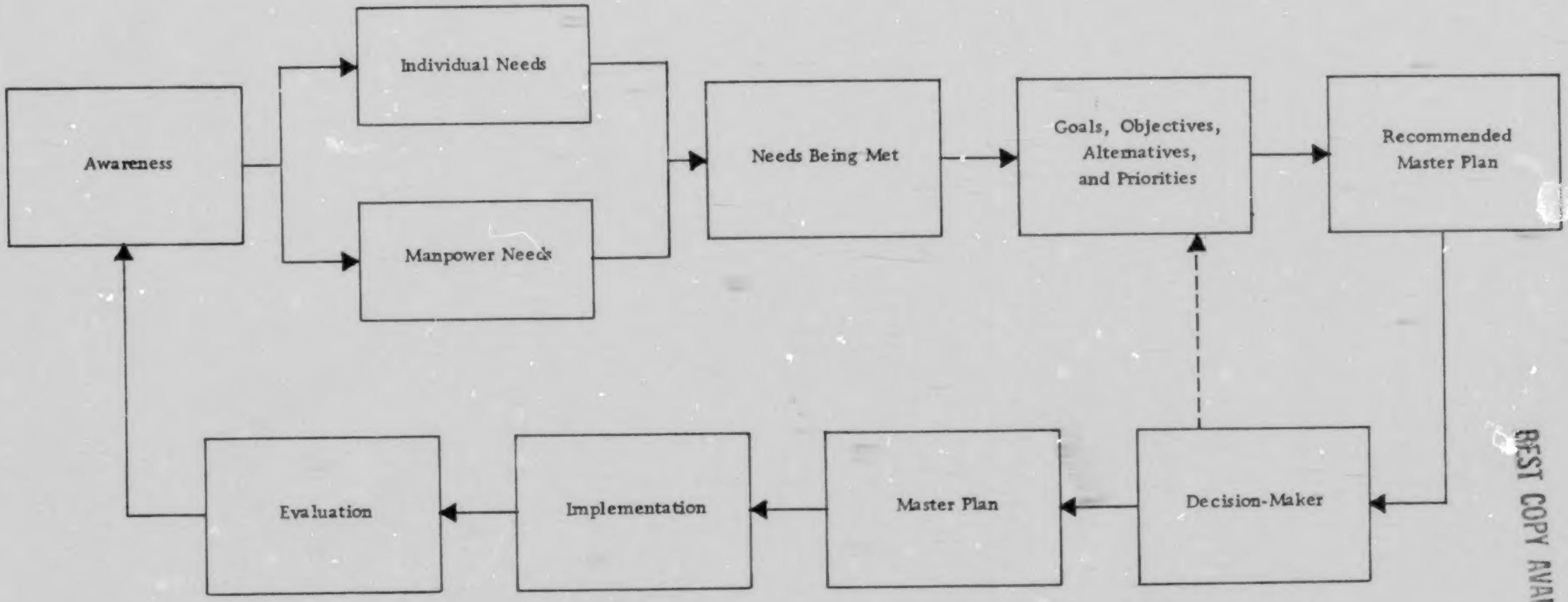
[1] Oklahoma State Plan

EXHIBIT XXIV

Economic Development Administration

OKLAHOMA VOC-ED PLANNING PROCESS


Awareness
Individual Needs
Manpower Needs
Needs Being Met
Goals, Objectives, Alternatives, and Priorities
Recommended Master Plan
Decision-Maker
Master Plan
Implementation
Evaluation

the experience of the first year of operations and to implement a series of steps to refine the OTIS data collection methodology. These steps include:

- Conduct a census survey of three segments of nonmanufacturing employment:
  - Mining
  - Contract construction
  - Transportation
- Analyze and adjust the student data system from the standpoint of feasibility. Determine system adjustments and identify users and user needs.
- Define sources of supply data and develop procedures for obtaining supply information.
- Review the former student follow-up system to identify procedural changes. In addition, identify user needs and develop reporting formats.
- Prepare and initiate procedures for updating manpower supply and demand components of the system.
- Analyze pilot study results to determine further steps in the implementation process.
- Develop comprehensive lists of private and public training programs within the state.

3. OTIS OKLAHOMA AND OTIS KENTUCKY EACH HAVE UNIQUE COST CHARACTERISTICS

Exhibit XXV, following this page, presents the separate costs for developing and operating OTIS in Oklahoma and Kentucky:

- Development costs include expenditures for system design, development, programming, and test activities.
- Operating costs include the normal expenses incurred in collecting supply and demand data, producing and distributing the interface statistics, and utilizing the other subsystems for planning and resource allocation.

EXHIBIT XXV

Economic Development Administration

OTIS DEVELOPMENT AND OPERATING COSTS IN OKLAHOMA AND KENTUCKY

		Oklahoma	Kentucky
1.	DEVELOPMENT COSTS		
(1)	Demand Subsystem	$ 203,500	$ 101,997
(2)	Supply Subsystem		--
(3)	Interface Subsystem		--
(4)	Follow-Up Subsystem		22,694
(5)	Educational Resources Subsystem	--	--
	Total Development Costs	$ 203,500	$ 124,691
2.	ANNUAL OPERATING COSTS		
(1)	Demand Subsystem	$ 18,938	$ 110,356
(2)	Supply Subsystem	9,764	51,890
(3)	Interface Subsystem	2,500	--
(4)	Follow-Up Subsystem	--[1/]	--
(5)	Educational Resources Subsystem	--	23,180
	Total Operating Costs	$ 31,202	$ 185,426

[1/] Costs of the Follow-Up Subsystem are included in the Supply Subsystem.

Source: The source and derivation of the Oklahoma and Kentucky costs are contained in Appendices B and C, respectively.

As expected in a pioneering effort, OTIS development costs are higher in Oklahoma than in Kentucky. Conversely, annual operating costs are higher in Kentucky because of the demand data collection methodology utilized. The composition of these costs in both states is detailed below.

(1) The Costs Of Developing And Operating OTIS Oklahoma Are Approximately $200,000 and $31,000, Respectively

The costs of developing and operating OTIS in Oklahoma are presented in Exhibit XXV. The development costs were incurred over several years; the operating costs are based on Fiscal Years (FY's) 1972-1975.

The estimated development costs of approximately $200,000 are comprised of:

- A grant of $153,500 to the Oklahoma State University Research Foundation from various federal and state agencies for system design and development
- Computer time and other related expenses of approximately $50,000

The annual cost of operating OTIS in Oklahoma is approximately $31,000. These operating costs include:

- $18,938 for the demand subsystem
- $ 9,764 for the supply and follow-up subsystems
- $ 2,500 for the interface subsystem

The relatively low annual operating costs reflect the fact that in Oklahoma benchmark demand data are collected through a sample every four years.

The calculation of the annual operating cost of the demand subsystem is detailed in Appendix B. Essentially, this cost was derived as follows:

- The total costs of the OESC contract with the Oklahoma Department of Vocational Education and Office of Community Affairs and Planning (OCAP) were $120,000.
- The total costs of the OESC baseline survey data collection effort were approximately $102,500.

- The OTIS share of this expenditure was approximately $58,300. The remaining costs are attributed to OCAP.

- The update costs in FY 1973, 1974, and 1975, are estimated to be approximately $7,450, $4,980, and $4,980, respectively.

- The total baseline and update costs of approximately $75,750 are divided by four to obtain annual operating costs of $18,938.

The allocation of the annual costs of the supply and follow-up subsystems is also detailed in Appendix B. Specifically, these costs are a portion of the total annual costs of operating the student accounting system.

(2) Development And Operating Costs of OTIS Kentucky Are Approximately $125,000 And $185,000, Respectively

An accurate determination of the true costs of the OTIS model in Kentucky is difficult because all costs are recorded in line-item budgets. Thus, the allocation of expenditures to particular activities requires reconstruction of work loads, assignments, and supportive expenses. The reconstruction and allocations utilized herein were developed in conjunction with key officials in Kentucky. All of the assumptions and calculations are detailed in Appendix C.

As displayed in Exhibit XXV, following page 62, it has cost approximately $125,000 to develop the OTIS model in Kentucky. This figure is comprised of approximately $102,000 for the demand system and $22,700 for the follow-up system. The demand subsystem development costs include:

- $68,697 for contractual and consulting services for system design and development

- An estimated $14,500 for computer program development

- An estimated $18,800 in EDA technical assistance support

The costs for developing the follow-up subsystem represent only Kentucky's share of an EDA contract with Ohio State University for the development of a system for Kentucky and West Virginia.

The current operating costs for OTIS Kentucky are approximately $185,500 and include:

- $110,356 for the demand subsystem
- $ 51,890 for the supply subsystem
- $ 23,180 for the education resources subsystem

The demand costs are comprised principally of personnel costs and travel expenses. The costs of the field staff alone were over $70,000, including over $50,000 for the salaries of field surveyors. The salaries of field surveyors were included because, in our judgment, they represent a valid demand data collection expenditure. Obviously, if these expenditures were not included, total operating costs would be substantially less. With the exception of approximately $10,000 in materials for the supply subsystem, personnel expenditures comprise the costs of the supply and education resources subsystems.

Determining annual operating costs in Kentucky is difficult because much of OTIS still is not fully operational. In our judgment, the annual costs of collecting demand data will remain at current levels because of the census approach to demand data collection or increase due to the larger number of nonmanufacturing employers to be surveyed. This assumption is reasonable and is in accordance with the assumptions of key personnel involved with OTIS. When the remaining subsystems are implemented fully, operating costs will probably equal or exceed current expenditures. Consequently, the annual operating costs of OTIS in Kentucky are estimated to be approximately $185,000.

4. THE COSTS OF REPLICATING THE KENTUCKY DEMAND DATA COLLECTION SYSTEM ARE EXCESSIVE

The fundamental distinction between the Oklahoma and Kentucky demand data collection methods is that Kentucky conducts a census and Oklahoma, a sample. In addition, Kentucky utilizes personal interviews exclusively and Oklahoma contacts large employers personally and small employers by mail and telephone. In result:

- Oklahoma attempted to obtain data from a sample of 2,636 employers from all sectors of the state's economy at a field data collection cost of $16,000, or approximately $6 per employer.
- Kentucky attempted to obtain data from a census of 2,894 employers in the manufacturing sector at a field data collection cost of approximately $80,000, or approximately $28 per employer.

Exhibit XXVI, following this page, lists the number of employers and total reported employment in Kentucky by major industry group. This exhibit also presents the estimated cost of conducting a census of Kentucky employers. The total field cost of demand data collection is $1.2 million, assuming a cost per firm of $25.00. Retail trade employers comprise 33 percent of the number of employers and only 20 percent of total employment. If these smaller firms were excluded or surveyed by mail, demand data collection costs for the remaining firms still would be over $800,000. Conversely, a 10 percent sample similar to that used in Oklahoma would cost from approximately $29,000 to $120,000, depending on the extent of the personal interviews. Thus, the additional costs of conducting a personal interview census could be more than $1 million.

Exhibit XXVII, following Exhibit XXVI, presents the estimated cost of replicating the Kentucky and Oklahoma demand data collection methodologies in other states.

- The cost of utilizing a census ranges from slightly over $200,000 in Nevada to over $8 million in New York.
- The cost of using a 10 percent sample similar to the sample used in Oklahoma ranges from $4,890 to nearly $200,000.

The additional cost of conducting a personal interview census ranges from nearly $200,000 in Nevada to over $7.8 million in New York. Thus, in our judgment, the cost of utilizing the Kentucky OTIS demand data collection approach is excessive.

* * * *

EXHIBIT XXVI

Economic Development Administration

OTIS KENTUCKY DEMAND DATA COLLECTION COST ESTIMATES

Major Industry Group	Total Reported Employment	Number of Reporting Units	Estimated Data Collection Costs		
			Census @	10% Sample @:	
			$25/Unit	$25/Unit	$6/Unit
Agriculture	2,613	342	$ 8,550	$ 850	$ 204
Contract Construction	39,716	4,460	111,500	11,150	2,676
Mining	29,472	1,092	27,300	2,730	654
Manufacturing	234,508	2,214	55,350	5,535	1,326
Transportation	40,354	2,108	52,700	5,270	1,266
Wholesale Trade	46,699	3,751	93,775	9,378	2,250
Retail Trade	138,944	16,305	407,625	40,763	9,786
Financial, Insurance, and Real Estate	35,641	3,930	98,250	9,825	2,358
Services	123,466	13,142	328,550	32,855	7,884
Unclassified	6,763	1,465	36,625	3,663	882
Total	698,176	48,809	$ 1,220,225	$ 122,019	$ 29,286

Total State Employment	928,000
Percentage Reported	75.28

EXHIBIT XXVII

Economic Development Administration

OTIS REPLICATION COST ESTIMATES

Data Collection Method	State				
	Florida	Pennsylvania	Tennessee	Nevada	New York
Kentucky--Census					
Number of Reporting Units	129,414	169,586	64,327	8,146	326,203
Field Data Collection Costs @ $25.00/Unit	$ 3,235,350	$ 4,239,650	$ 1,608,175	$ 203,650	$ 8,155,075
Oklahoma--Sample					
Number of Reporting Units @ 10%	12,941	16,959	6,433	815	32,620
Field Data Collection Costs @ $6.00/Unit	$ 77,646	$ 101,754	$ 38,598	$ 4,890	$ 195,720
Cost Difference	$ 3,157,704	$ 4,137,896	$ 1,569,577	$ 198,760	$ 7,959,355

This chapter has presented our findings regarding the operational effectiveness and overall impact of OTIS. In general, the systems in both Oklahoma and Kentucky have widespread support and are providing data that are utilized in the planning processes. However, several major problems persist. In our judgment, the employer forecasts of manpower demand are unreliable.[1] In addition, the personal interview census utilized in Kentucky to collect current and forecast demand is not cost effective. Equally important, OTIS manpower supply does not include all informally trained individuals. Our recommendations for overcoming these problems are presented in the next chapter.

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[1] These results are neither new nor surprising. Many experts in the field believe employer-based forecasts are not reliable. In fact, as a result of numerous studies, DOL has dropped a similar program. See: (1) John Fletcher Wellimyer Associates, An Appraisal Of Area Skill Surveys In Battle Creek, Michigan, And Trenton, New Jersey, November, 1965, Washington, D. C.; (2) Chernick, Jack, Manpower Forecasting Through The Occupational Needs Survey, Institute of Management and Labor Relations, Rutgers--The State University; (3) Hartle, Douglas G., Canadian Employer Forecast Survey, Canadian Studies In Economics, University of Toronto Press, 1962; (4) Moser, Collette H., An Evaluation Of Area Skill Surveys As A Basis For Manpower Policies, an unpublished doctoral dissertation at the University of Wisconsin, 1971; (5) Labor Market Information And The Federal-State Employment Service System, Report by the Advisory Committee on Research to the U. S. Employment Service, U. S. Department of Labor, Washington, D. C.; and (6) Kidder, David E., Review And Synthesis Of Research On Manpower Forecasting For Vocational Education, The Center For Vocational and Technical Education, The Ohio State University, Columbus, Ohio, February, 1972.

IV. RECOMMENDATIONS

The purpose of this study was to analyze OTIS in Kentucky, determine its strengths and weaknesses, and recommend system improvements. Since OTIS Kentucky is still under development, the ongoing OTIS system in Oklahoma also was examined. System strengths and weaknesses were described in the succeeding chapter. Our recommendations for improving OTIS are presented below.

1. THE DEVELOPMENT AND TESTING OF OTIS KENTUCKY SHOULD BE CONTINUED

The basic purpose of OTIS is to provide manpower and vocational education planners with state and regional data. OTIS Kentucky is still under development. To date, the system has gained widespread support and preliminary data are being utilized in the planning process. In our judgment, the type of information provided by OTIS meets a valid need and we believe the developmental effort should be continued.

Kentucky plans to continue OTIS operations and is willing to commit state funds for further system development. In addition, the state has requested further funds from EDA. We recommend that these additional monies be granted. We also recommend that technical assistance be provided by BLS. Collectively, these federal and state resources should be utilized to make the following improvements.

- Implement a new employment data collection methodology by expanding the Occupational Employment Statistics (OES) program.
- Implement and test a new approach to forecasting manpower demand, using the industry-occupational matrix technique developed by BLS.

- Improve the estimates of manpower supply by obtaining additional long-term information concerning occupational and geographic mobility.
- Increase the rapport between employers and vocational education personnel by discussing with each employer his particular needs.

Each of these recommendations is discussed in detail below.

2. THE OES SURVEY SHOULD BE UTILIZED TO COLLECT CURRENT EMPLOYMENT DATA

In 1970, BLS, the Manpower Administration (MA), and a number of state employment agencies joined to initiate the OES survey. (The development, objectives, and current status of this survey and related BLS/MA programs are described in Appendix J.) Kentucky was not one of the initial states participating in this program. However, the OES survey is now being implemented in Kentucky. In our judgment, this program should be used to collect current employment data for use in OTIS.

The OES survey was selected for the following reasons.

- Collecting manpower data is an integral part of the ES function.
- ES personnel are expert in this field.
- Manpower data are the responsibility of DOL and affiliated state agencies under the 1968 amendments to the Vocational Education Act of 1963.
- The survey utilizes a statistical sample rather than a census.
- The adoption of the OES survey will eliminate redundant OTIS data collection activities.
- The survey is compatible with the systems in use in other states and with the BLS industry-occupational matrix.

The OES survey is one of three components of the OES program and is designed to produce estimates of occupational employment by industry for the nonagriculture wage and salary work force. Specifically, the OES survey has the following objectives.

- Develop occupational employment estimates by industry to provide the basis for producing a time series of estimates of employment by occupation
- Provide data about the occupational composition of industries, including:
  - Differences in occupational composition within an industry, e.g., by size of establishment, process
  - Extent of inter-establishment variability
  - Changes in occupational composition in response to such external factors as changing technology
- Provide occupational information in a form that permits the development and improvement of industry-occupational matrices at the state and area levels and, ultimately, at the national level

In our judgment, the OES survey can meet the information needs of OTIS users in Kentucky if certain refinements are made. Our recommendations for specific refinements in the survey parameters are described below.

(1) Jointly Develop A Sampling Procedure That Will Permit Compilation Of Reliable, Local-Level Data

As noted above, OTIS data are utilized in the educational planning process in both Oklahoma and Kentucky. In addition, information from OTIS has helped to attract new industry in both states. Clearly, job prospects and trends data are essential for:

- School and vocational/technical education administrators
- Manpower program administrators
- Economic development officials
- ES and vocational counselors

Equally important, disaggregated data are required. However, sample size, data collection problems, and costs increase with the number of substate areas involved. Thus, the increased cost and complexity of an expended sample must be balanced against the need for improved data.

Currently, OTIS collects data from a census of employers, but this method is not cost effective. It is our understanding that the ES in Kentucky plans to select a sample to permit data compilation for four principal regions. This decision should be reviewed carefully with OTIS users, especially the Bureau of Vocational and Technical Education. In our judgment, alternative sample designs and concomitant data reliability should be developed. For example, the reliability and costs of collecting four regional data samples should be compared with the reliability and cost involved in collecting data from the 15 regions utilized in the OTIS survey. In this respect, the existing OTIS data bank, which contains 1972 employment by occupation from the census of manufacturing employers, might be useful in developing sampling alternatives. This information then can be utilized to make a valid judgment regarding the most appropriate sampling methodology. Perhaps combining certain OTIS regions to limit the level of data aggregation and reduce cost will be warranted.

(2) Complete An Entire OES Survey As Soon As Possible

The standard OES survey consists of three separate annual surveys.

- Manufacturing employers
- Nonmanufacturing employers
- Trade employers

Each group is surveyed every three years, using the standard forms developed by BLS for the industries in each group. Existing plans provide for the conduct of the manufacturing survey in the summer of 1974. Thus, nonmanufacturers and trade employers will be contacted in 1975 and 1976, respectively.

We recommend that this schedule be shortened. Given the immediacy of information needs and the necessity of testing and validating a state industry-occupational matrix, we believe all three major categories of employers should be surveyed this year. More importantly, we recommend that firms from all three groups be surveyed annually for the initial three-year cycle. This will provide current data and an immediate time series to develop the BLS "shift" matrix described below. At the end of the three-year cycle, data and forecasts should be available to evaluate properly the feasibility and impact of switching to the regular three-year survey cycle.

MA estimates that the first round of any portion of the OES survey in Kentucky, such as manufacturing, would cost approximately $48,000. This includes the costs of developing a current sampling frame stratified by SIC code and size of establishment and selecting a stratified random sample. Thus, in our judgment, the cost of conducting the modified OES program recommended above still will be less than the existing cost of collecting OTIS data. More importantly, in the long run, the OES survey will be even more cost effective. For example, it is probable that once the program is fully operational the regular three-year cycle can be utilized. In addition, smaller samples will be utilized in future surveys, since industries which do not exhibit significant changes in their occupational structure can be sampled less frequently and those which have similar occupational structures throughout the nation need be sampled in only one or two labor market areas.

(3) Utilize The Survey Data To Develop Industry-Occupational Matrices For The State

The OES survey data should be utilized immediately to develop regional industry-occupational matrices for Kentucky. The process that has been used to prepare occupational employment estimates from the sample data involves four basic steps.

- The reported occupational employment figure for an establishment is multiplied by the establishment's sample weight.

- The weighted occupational employment figure for the establishment is summed with similar data for all other sample establishments in the same industry size class (cell).

- The sum of the weighted occupational employment data is divided by the sum of the weighted total employment for all reporting establishments in the cell. This produced the occupational ratio for the cell.

- The ratio is multiplied by the total industry employment figure for the cell, as determined from ES 202 data, to yield the estimated number of workers in each occupation in the cell.

This process can be expressed by the formula below.

$$P_c = \left(\frac{\Sigma p_i w_i}{\Sigma e_i w_i} \right) M$$

where:

P_c = Estimate for occupation P in an industry size cell

p_i = Reported employment for occupation P by number of establishments in an industry size cell

M = The ES 202 benchmark employment for the industry size cell

e_i = Reported total employment in the ith establishment in an industry size cell

w_i = The reciprocal of the sample weight or the sampling ratio of the ith establishment in an industry size cell

The occupational estimates produced for each cell can be aggregated at various levels to produce data on the occupational composition of the wage and salary work force at different levels of industry detail, e.g., three-digit or two-digit SIC code industries. Subsequently, these regional industry-occupational matrices can be developed and utilized in conjunction with the BLS forecasting methodology to project manpower demand by occupation.

3. OTIS KENTUCKY SHOULD UTILIZE THE MANPOWER DEMAND FORECASTING METHODOLOGY DEVELOPED BY BLS

The results of our analysis of employer forecasts and of the regional occupational summaries in Kentucky indicate that many of the forecasts were inaccurate. More importantly, the annual cost of conducting a personal interview census is inordinately high compared to the cost of conducting a sample. Consequently, in our judgment, the BLS demand data forecasting methodology should be substituted for the employer forecast for the following reasons.

- The BLS program is the result of years of research conducted by acknowledged experts in manpower demand forecasting.
- The BLS methodology consists of a rigorous analytical framework. Thus, exogenous variables affecting manpower demand can be accommodated, e.g., the present energy crisis, monetary and fiscal constraints, and wage and price controls.
- Forecasting manpower demand is an integral part of the overall function of ES.

The National/State Industry-Occupation Matrix System was inaugurated by BLS in 1972. The overall system was developed in conjunction with the MA and state employment security agencies to develop occupational information at the state and regional levels.

(1) Utilize The Kentucky Interim Manpower Projections And Industry-Occupation Matrix To Develop Immediate Forecasts

BLS has produced interim industry-occupation projections for Kentucky and a 1970 matrix. This matrix is similar in format, concept, and data base to the BLS national matrix and is based on a special tabulation of industry by occupation by class of worker from the 1970 census, as well as other industry data. The purpose of this system is to provide:

- A state employment matrix for over 400 occupations in over 200 industries that can be utilized to estimate occupational requirements with greater accuracy than national patterns alone
- A flexible, multipurpose computer system to allow for matrix updating, e.g., to supplement the matrix with data from OES survey and prepare substate estimates

This system also includes occupation-specific death and retirement rates for Kentucky that can be utilized to estimate total occupational demand. Since the OES matrix-based projections will not be available the first year, we believe this interim matrix should be utilized to develop manpower demand projections.

(2) Utilize The State Matrices To Produce Annual Updates Of Manpower Demand

As noted earlier, two years of OES data are necessary to determine shifts in industry-occupation ratios. Projections for the second year can be made using the matrices developed specifically for substate areas. In addition, the actual manufacturing employment figures for 1972 obtained by OTIS might be useful for matrix development. In turn, these matrices can be utilized in conjunction with industry employment projections to develop forecasts of manpower demand by occupation. The state ES should determine appropriate forecast periods in consultation with major data users and prepare total employment projections by industry. For example, 3-, 5-, and 10-year projections with annual updates might be feasible. Subsequently, the accuracy of these state and regional forecasts should be evaluated.

4. THE ESTIMATES OF MANPOWER SUPPLY SHOULD BE IMPROVED

The OTIS estimates of manpower supply are presently understated because a substantial number of individuals entering the job market from nonvocational schools are not included. In addition, migration and commutation patterns can have a significant impact on supply in any particular area. Consequently, additional research on occupational and geographic mobility should be undertaken.

(1) Adjust The Supply Figures For Informally Trained Individuals

The principal deficiency in the OTIS supply totals is that informally trained individuals are not included, e.g., persons from high schools or individuals who have become proficient through informal training or experience on the job. The number of informally trained individuals is extremely difficult to quantify particularly at the occupation level. However, because net manpower requirements can be substantially affected by an understatement of supply, some effort must be devoted to estimating the extent of the understatement.

There is a paucity of data in this area. BLS, in an attempt to alleviate this problem, is currently conducting two studies in this area.

- An analysis of the sources of training based on 1970 census data
- An examination of training provided by employers based on the 1970 census of manufacturers

Both of these studies may yield valuable information concerning the incidence of informally trained individuals in the work force. Some of the data also might be relevant at the state level or suggest similar research using state data. In addition, the expanded scope of the follow-up subsystem discussed below will provide additional information on which to base expansion of the OTIS supply figures.

(2) Identify The Extent Of Geographic Mobility

As noted earlier, labor mobility can have a significant impact on manpower supply in a particular area and, hence, on net manpower requirements. In the judgment of knowledgeable officials, current net migration in Kentucky involves approximately 1,500 individuals per year. Thus, the impact probably is not significant. However, intra- and interstate commutation does involve a substantial proportion of the work force in Kentucky.[1] It probably is not feasible to quantify commuting patterns by occupation. However, two approaches that could be taken to provide additional information to be used in conjunction with the regional OTIS net requirements data are:

- Intrastate Commuting--The county commutation patterns could be utilized to develop approximate commuting patterns for the regions selected for OTIS. These figures then could be utilized in conjunction with the net manpower data to make planning decisions.
- Interstate Commuting--Demand and supply estimates for the adjacent states should be compiled so that judgments can be made utilizing data for the entire interstate area.

In addition, the expanded follow-up system discussed below will yield data on commuting patterns.

5. ADDITIONAL FOLLOW-UP STUDIES SHOULD BE CONDUCTED

Currently, follow-up in Kentucky is based on information from the student accounting system. All terminees from state vocational-technical schools and area vocational education centers are sent questionnaires shortly after graduation. The follow-up includes information on the post-schooling experience of terminees by occupation and relationship to training programs, income, geographic mobility, and job satisfaction. In addition, a sample of terminees is interviewed personally to determine if non-response bias exists. These follow-up procedures have two principal shortcomings.

- The period shortly after graduation tends to be a transitional period and may not accurately represent long-range trends.
- Only terminees of occupational training programs are included.

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[1] Commuting Patterns Of Kentucky Counties, Kentucky Department of Commerce, Frankfort, Kentucky.

In our judgment, additional follow-up studies should be conducted two to five years after graduation. Further, longitudinal data could be gathered by following the same terminees over one or more years. More importantly, terminees from non-occupational training programs should be included, e.g., from high schools and community colleges. The results of these studies should provide data with which to assess the long-term impact of vocational training and to determine the occupational and geographic mobility of graduates from all types of schools in Kentucky.

6. THE QUALITATIVE ASPECTS OF VOCATIONAL EDUCATION SHOULD BE EMPHASIZED TO INCREASE EMPLOYER RAPPORT

One of the important intangible benefits of OTIS is the rapport obtained with employers. However, as noted earlier, rapport was not established with some employers for a variety of reasons. In our judgment, the level of rapport can be increased by separating data collection from other activities and by emphasizing the qualitative aspects of vocational education. For example, under current procedures, rapport is sought by asking the employer for current and forecast employment by occupation and by emphasizing the benefits of OTIS. This is done within the tight time constraints necessary to meet data collection requirements. Consequently, scheduling and conducting interviews are difficult for both vocational education personnel and employers.

Using the OES/BLS demand data collection and forecasting methodology, the industrial coordinators will receive the OTIS forecasts for their region. Subsequently, as part of their normal functions, the coordinators can discuss these occupational projections and related information with employers. More importantly, they can take the time to discuss the qualitative aspects of vocational education, e.g., the characteristics of a typical job and/or worker.

- Job characteristics include duties, working conditions, hours, wages, shifts, fringe benefits, and opportunities for advancement

- Employee characteristics include skills, attitudes, physical requirements, educational and training requirements, and work experience

In addition, current vacancies for placement purposes, potential technological changes, such as the introduction of new machines or products, and the employer's recent experience with graduates should be discussed. In our judgment, bringing a forecast to the employer, obtaining his ideas on its validity, and discussing how vocational education can meet his particular needs, will result in a higher level of rapport than exists currently.

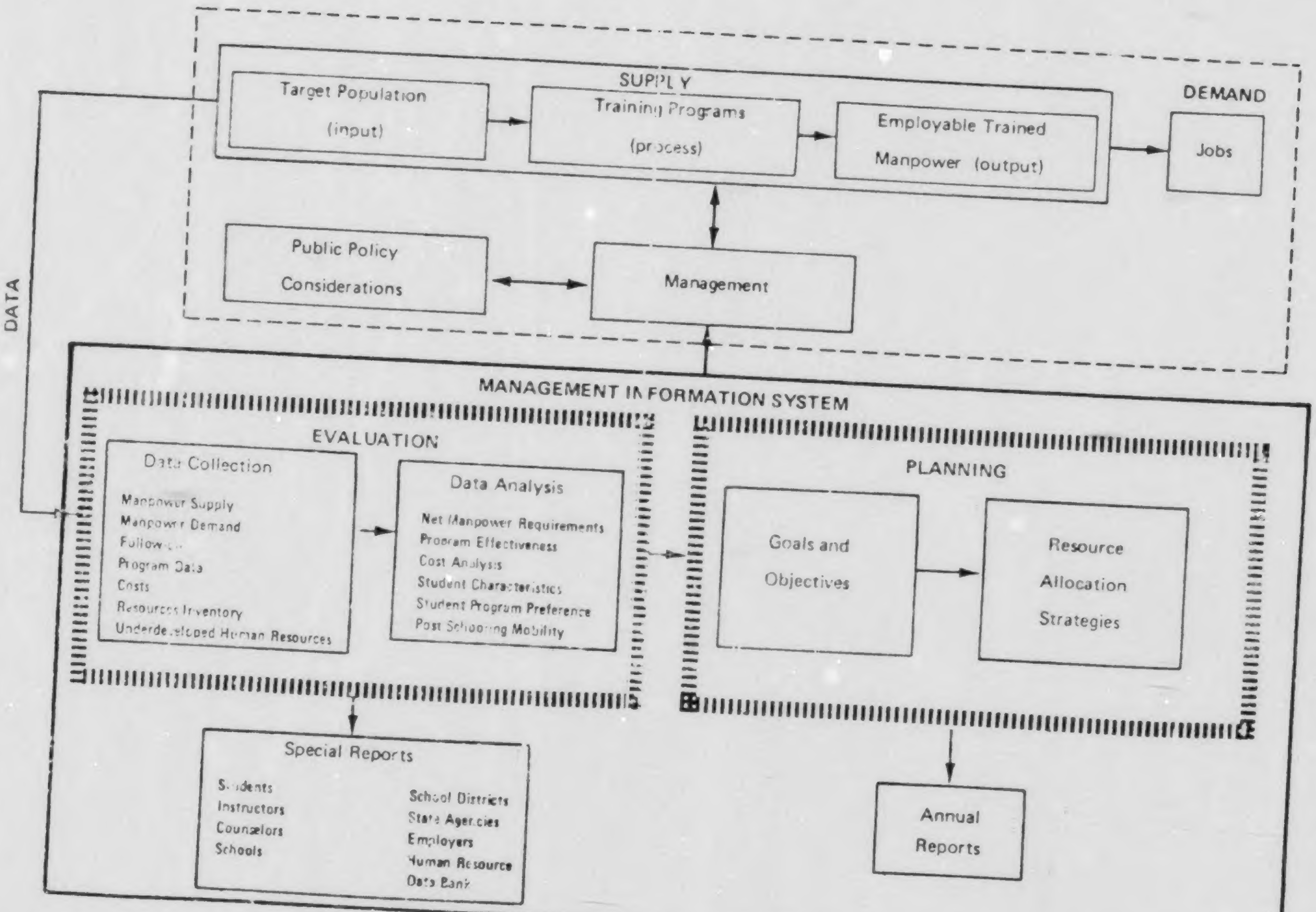
APPENDIX A

CONCEPTUAL DIAGRAM OF MANAGEMENT INFORMATION SYSTEM FOR VOCATIONAL EDUCATION

APPENDIX A(1)

Economic Development Administration

CONCEPTUAL DIAGRAM OF MANAGEMENT INFORMATION SYSTEM FOR VOCATIONAL EDUCATION


SUPPLY
Target Population
(input)
Training Programs
(process)
Employable Trained
Manpower (output)
DEMAND
Jobs
Public Policy
Considerations
Management
DATA
MANAGEMENT INFORMATION SYSTEM
EVALUATION
Data Collection
Manpower Supply
Manpower Demand
Follow-up
Program Data
Costs
Resources Inventory
Underdeveloped Human Resources
Data Analysis
Net Manpower Requirements
Program Effectiveness
Cost Analysis
Student Characteristics
Student Program Preference
Post Schooling Mobility
PLANNING
Goals and
Objectives
Resource
Allocation
Strategies
Special Reports
Students
Instructors
Counselors
Schools
School Districts
State Agencies
Employers
Human Resource
Data Bank
Annual
Reports

SOURCE: An Overview of the Management Information System for Vocational Education (MISVE), The Center for Vocational and Technical Education, Ohio State University, Columbus, Ohio

APPENDIX B

SOURCES AND DERIVATION OF OKLAHOMA OTIS COST ESTIMATES

SOURCES AND DERIVATION OF OKLAHOMA OTIS COST ESTIMATES

This appendix presents the estimated cost of developing and operating OTIS in Oklahoma. The sources, assumptions, and derivation of these costs are presented in the following five exhibits:

- OTIS Oklahoma Development and Operating Costs
- Cost of OESC Demand Data Collection
- Calculation of OTIS Demand Data Collection Costs for Fiscal Year 1972
- Calculation of the Supply and Follow-Up Subsystem Costs
- Calculation of OTIS Annual Operating Costs

EXHIBIT B-I

Economic Development Administration

OTIS OKLAHOMA DEVELOPMENT AND OPERATING COSTS

1. DEVELOPMENT COSTS

(1) Demand Subsystem (2) Supply Subsystem (3) Interface Subsystem (4) Follow-Up Subsystem	$203,500[1]
Total Development Costs	$203,500

2. OPERATING COSTS

(1) Demand Subsystem	$ 58 326[2]
(2) Supply Subsystem	9,764[3]
(3) Interface Subsystem	2,500
(4) Follow-Up Subsystem	--[3]
Total Operating Costs	$ 70,590

Notes:

[1] This figure was obtained from Dr. Warren Edmison, Director, Oklahoma State University Research Foundation. The amount is comprised of a grant to Oklahoma State University for $153,500 from various federal and state agencies and $50,000 for computer time and other related expenses. Funds were provided by:

- DOL--$99,390
- Ozarks Regional Commission--$40,000
- Oklahoma Industrial Development and Park Department--$34,863

The remainder of the $203,500 was comprised of staff release time from the State Department of Vocational and Technical Education, OESC, and Private Schools Association.

[2] This figure is the OTIS share of the total OESC demand data collection costs of $102,574. The OESC data collection costs are detailed in Exhibit B-II. The derivation of the OTIS share is explained in Exhibit B-III. The calculation of annual operating costs is explained in Exhibit B-V.

[3] Student Accounting System costs are $30,112, as detailed in Exhibit B-IV. Supply subsystem and follow-up subsystem costs are estimated to total $9,764.

EXHIBIT B-II

Economic Development Administration

COST OF OESC DEMAND DATA COLLECTION

7

		Fiscal Year			
		1972	1973	1974	1975
Personal Services		$ 63,867.02	$ 5,125.84	$ 1/	$ 1/
Expenses:	Benefits	$ 17,261.49	$ 1,391.39		
	Supplies	975.29	86.81		
	Communications	601.26	121.84		
	Travel	10,253.47	21.01	1/	1/
	Equipment	5,542.76	151.83		
	Premises	3,605.41	452.93		
	Services, Other	467.78	105.78		
	Subtotal Expenses	$ 38,707.46	$ 2,331.59		
Total Expenditures		$ 102,574.48	$ 7,457.13	$ 4,984.20 1/	$ 4,984.19 1/
Cumulative Expenditures		$ 102,574.48	$ 110,031.61	$ 115,015.81	$ 120,000.00
Sources:	State Department of Vocational and Technical Education	$ 40,000.00	$ --	$ --	$ --
	Office of Community Affairs and Planning 2/	20,000.00	--	--	--
	Oklahoma Employment Security Commission	42,574.48	7,457.13	4,984.20	4,984.19
	Total	$ 102,574.48	$ 7,457.13	$ 4,984.20	$ 4,984.19

Source: Mr. Wayne Edge, Comptroller, Oklahoma State Employment Security Commission

Notes: 1/ Unexpended balance for coming fiscal years

2/ For a description of this project, see Exhibit B-III, Note

EXHIBIT B-III(1)

Economic Development Administration

CALCULATION OF OTIS DEMAND DATA COLLECTION COSTS FOR FISCAL YEAR 1972

I. Total FY '72 Expenditures: $102,574.48

II. Total Employers:		Units Surveyed	Personal Visits	Responses
	OTIS	2,636	1,087	1,865
	OCAP*	1,475	1,408	1,097
		4,111	2,495	2,962
III. Percentage of OTIS/OCAP:		64/36	44/56	63/37

IV. Estimate of OTIS/OCAP Field Data Collection:

1. Field Staff Costs

(1) Personal Services

. 11 Graduate Students @ $520/month x 12 weeks	$ 17,160.00		
. 2 ES Professional Staff @ 1 and 3 months @ $600 and $750, respectively	2,850.00		
. Benefits @ 20% ES staff only	570.00		
. Clerical Support (estimate)	4,500.00		
Estimated Total Personal Services		$ 25,080.00	

(2) Other Than Personal Services

. Travel and Per Diem Expenses	$ 10,253.47		
. Mailing (estimated 2800 pieces @ 24¢ each)	672.00		
. Communications	601.26		
Estimated Total Other Than Personal Services		11,526.73	
Total Estimated Expenditures for Field Data Collection			$ 36,606.73

2. Estimate of Field Cost Distribution		
	OTIS (44%)	$ 16,107
	OCAP (56%)	20,500

V. Estimate of Overhead and Project Management Costs:

1. Total Expenditures	$ 102,574.48
2. Total Field Cost Estimate	36,607.00
Total	$ 65,967.48

Note: * OCAP: Office of Community Affairs and Planning of Oklahoma. This survey was conducted simultaneously with the OTIS survey, and the entire effort was treated as a single data collection project. However, the OCAP project will not be repeated. Thus, OTIS expenses, in terms of future costs, should be separated.

EXHIBIT B-III(2)

VI. Estimated Distribution of Overhead and Project Management Costs:

1.	Estimated Overhead and Project Management Costs		$ 65,967.48
2.	Estimated Distribution	OTIS (64%)	$ 42,219
		OCAP (36%)	23,748

VII. Oklahoma OTIS Demand Cost Estimate:

1.	Field Data Collection Cost Estimate	$ 16,107	
2.	Overhead and Project Management Cost Estimate	42,219	
	Total OTIS Demand Cost		$ 58,326

Source: Demand Cost Estimates are based on data and assumptions developed in conjunction with Mr. William Hunter and Mr. Wayne Edge of the Oklahoma Employment Security Commission.

EXHIBIT B-IV

Economic Development Administratio

CALCULATION OF THE SUPPLY AND FOLLOW-UP SUBSYSTEM COSTS

1. Annual Student Accounting System Costs

(1) Administrative Personnel	$ 6,000
(2) Teacher Time--2 hours: 30 minutes (Enrollment Completion and Follow-Up): 1800 teachers @ $5.00/hour	9,000
(3) SAS Personnel (Full-Time)	8,000
. Additional Help	390
. Travel	1,716
(4) Computer Time--26 hours @ $35/hour	910
(5) Keypunch--100,000 cards @ 4¢/card	4,000
(6) Interrupt Card (completion of Follow-Up)--24 hours @ $4.00/hr.	96
Total	$ 30,112

2. Allocation of Supply and Follow-Up System Costs

(1) Supply Subsystem (2) Follow-Up Subsystem	$ 9,764

EXHIBIT B-V

Economic Development Administration

CALCULATION OF OTIS ANNUAL OPERATING COSTS

1.	Demand Subsystem Costs		
	(1) FY 1972 Baseline	$ 58,326	
	(2) FY 1973 Update	7,457	
	(3) FY 1974 Update	4,984	
	(4) FY 1975 Update	4,984	
		$ 75,751	
	Divided by 4 years		
	Demand Subtotal		$ 18,938
2.	Supply and Follow-Up Subsystem Costs		9,764
3.	Interface Subsystem Costs		2,500
	Total Annual Operating Costs		$ 31,202

APPENDIX C

SOURCES AND DERIVATION OF KENTUCKY OTIS COST ESTIMATES

APPENDIX C(1)

SOURCES AND DERIVATION OF KENTUCKY OTIS COST ESTIMATES

This appendix presents the estimated costs of developing and operating OTIS in Kentucky. The sources, assumptions, and derivation of these costs are presented in the following two exhibits:

- Derivation of Kentucky OTIS Cost Estimates
- Letter from Dr. Janie L. Jones

EXHIBIT C-I

Economic Development Administration

DERIVATION OF KENTUCKY OTIS COST ESTIMATES

I. DEMAND SUBSYSTEM			
1. Development Costs			
(1) Contractual and Consulting Services	$ 68,697 1/		
(2) Computer Program Development	14,500 1/		
(3) EDA Personnel Support	18,800 2/		
Subtotal		$ 101,997	
2. Operating Costs			
(1) Management Personnel	$ 27,768 1/		
(2) Field Personnel	70,088 3/		
(3) Travel	9,000 1/		
(4) Supplies	1,000 1/		
(5) Computer Support	2,500 4/		
Subtotal		110,356	
Total Demand Subsystem			$ 212,353
II. SUPPLY AND FOLLOW-UP SUBSYSTEMS			
1. Development Costs			
(1) Student Accounting	$ -- 5/		
(2) Follow-Up	22,694 6/		
Subtotal		$ 22,694	
2. Operating Costs			
(1) Personnel	$ 41,690 1/		
(2) Supplies	10,200 1/		
Subtotal		51,890	
Total Supply and Follow-Up Subsystems			74,584
III. EDUCATIONAL RESOURCES SUBSYSTEM			23,180 1/
TOTAL COSTS			$ 310,117
. Development Costs			$ 124,691
. Operating Costs			$ 185,426

Source:

1/ Exhibit C-II, copy of a letter from Dr. Janie L. Jones

2/ Estimated by MSI based on two man-days per week on-site

3/ Letter from Dr. Janie L. Jones includes $51,426 for costs of field surveyors to conduct only the census of manufacturing employers, i.e., subsequent employer survey costs are not included

4/ Estimated by Mr. Dave Portch of EDA Information Systems and Services Division

5/ No developmental costs for the Student Accounting System are included because the system was developed previously.

6/ Includes only Kentucky's share of the cost of an EDA contract with Ohio State University; total costs are approximately $100,000

EXHIBIT C-II(1)

Economic Development Administration

LETTER FROM DR. JANIE L. JONES

COMMONWEALTH OF KENTUCKY
Department of Education
BUREAU OF VOCATIONAL EDUCATION
FRANKFORT 40601

August 3, 1973

Dr. William J. Tobin
Economic Development Administration
Program Analysis Division
14th Street and Constitution Avenue N.W.
Washington, D. C. 20230

Dear Dr. Tobin:

I have gone through the cost estimates for Kentucky again, and I also asked Mr. Hume, Director of Fiscal Control and Financial Accounting, to look at it.

In addition, I am sending you a copy of the notes I made on the Oklahoma costs. I realize this has been revised and that some of these things may have been considered in the revision.

As I told you on the phone, here in Kentucky we feel that the benefits to be derived from the system are much greater than just the obvious ones.

I hope this will help in getting the disagreements worked out. If I can be of further help, please call.

Sincerely,

Janie L. Jones

Janie L. Jones, Director
Occupational Information Unit

JLJ/ew

Enclosure

EXHIBIT C-II(2)

KENTUCKY'S INFORMATION FOR TRAINING AND EDUCATION SYSTEM
COST ESTIMATES
August 1, 1973

I. Demand Component

(1) Coordinator (full time)	15,288		
Secretarial	4,740		
Director (½ time)	4,014		
	24,042		
Benefits @ 15.5%	3,726	27,768	
(2) Field Staff			
Industrial Coordinators	10,827		
Secretarial	5,331		
	16,158		
Benefits @ 15.5%	2,504	18,662	
TOTAL PERSONAL SERVICES		46,430	
(3) Travel			
Industrial Coordinators	4,500		
Field Surveyors	4,500*	9,000	
(4) Supplies		1,000	
TOTAL OPERATING COSTS (Demand)		56,430	

*If salaries of field surveyors are included, an additional $51,426 should be added (55,926 - 4,500) making a total of $107,856.

(5) Project Developmental Costs			
Computer program development	14,500		
Contractual and Consulting Services	68,697		
TOTAL DEVELOPMENTAL COSTS (Demand)		83,197	
TOTAL COSTS (DEMAND)			139,627

II. Student Accounting and Follow-Up System

(1) Coordinator (full time)	11,412		
Secretarial	4,512		
Director (½ time)	4,014		
	19,938		
Benefits @ 15.5%	3,090	23,028	
(2) Industrial Coordinators	10,827		
Secretarial	5,331		
	16,158		
Benefits @ 15.5%	2,504	18,662	

EXHIBIT C-II(3)

(3) Supplies		10,200	
TOTAL COST (SUPPLY & FOLLOW-UP)			51,890*

*The $22,694 charged to Ohio State was not an expenditure for Kentucky. This amount was received from Ohio State in support of the follow-up.

III. Educational Resources

(1) Coordinator (full time)	16,056	
Director (½ time)	4,014	
	20,070	
Benefits @ 15.5%	3,110	
TOTAL COST (EDUCATIONAL RESOURCES)		23,180
TOTAL OPERATING COSTS		131,500
TOTAL DEVELOPMENT COSTS		83,197
		214,697

Total Costs Annualized for a 5 year period:

Operating Costs (131,500/year for 5 years)	657,500
Developmental Costs	83,197
Total 5 year operating and developmental costs	740,697
Costs Annualized for 5 years	148,139

Prepared by:

Janie L. Jones, Director
Occupational Information Unit

APPENDIX D

SAMPLE OKLAHOMA AND KENTUCKY QUESTIONNAIRES

KENTUCKY QUESTIONNAIRE

rvey Number: 27

Report on Occupational Employment

PRINTING and PUBLISHING Industry, 1972

KENTUCKY MANPOWER PLANNING COUNCIL
BUREAU OF VOCATIONAL EDUCATION
OCCUPATIONAL EMPLOYMENT SURVEY

Report No.

Address Label
to be placed here

Change address if incorrect

THIS INFORMATION WILL BE MADE AVAILABLE TO VOCATIONAL EDUCATION AND OTHER AGENCIES FOR MANPOWER PLANNING, CAREER GUIDANCE, AND CURRICULUM CHANGE PURPOSES.

General Instructions

REPORTING UNIT: Complete this report for your company operation (Reporting Unit) identified on the above mailing label. To help multi-unit employers correctly identify the Reporting Unit, its physical location has been printed in the lower left portion of the label and our estimate of its total employment appears as a six digit number in the lower right hand corner of the label. (Multi-unit employers may receive questionnaire forms for more than one Reporting Unit).

REPORTING PERIOD: Report information for a payroll period that includes May 12, 1972. If, because of unusual operational problems (e.g., work stoppages, temporary shut-downs), the May 12 period is not a typical period, please report for a period nearest May 12 in which operations most closely approximate the normal.

PART I. GENERAL INFORMATION

1. **TOTAL EMPLOYMENT** .... ☐ (9999)

Enter the total number of persons on the payroll covered by this report who worked full- or part-time or received pay for any part of the period reported. Include salaried officers of corporations and executives and their staffs, but exclude proprietors, members of unincorporated firms, and unpaid family workers. Include persons on vacations and sick leave for which they received pay directly from your firm for the period reported but exclude persons on leave without company pay the entire period and pensioners and members of the Armed Forces carried on the rolls but not working during the period reported.

2. **NATURE OF BUSINESS**

(a) Describe the principal activity and the major product or service of the Reporting Unit (e.g., Manufacturing–women's shoes; Warehousing–steel products; Research–radio and T.V. receiver; and Retail trade–shoe store).

____

(b) Is the Reporting Unit primarily engaged in performing services for other units of your company? Yes ☐ No ☐

If "yes" please check the one block below that best describes the service being perfomred.

(1) ☐ Central administrative office
(2) ☐ Research, development, or testing
(3) ☐ Storage (Warehouse)
(4) ☐ Other (Specify, e.g., powerplant) ____________

3. **STATUS OF ACTIVITY** - Payroll period that includes May 12, 1972.

If the reporting unit did not operate under your management during the May 12 period, please check the appropriate block below:

☐ This unit has been sold or merged. New name and address is: ____________________
☐ This unit is out of business. ____________________
☐ Other (Describe) ____________________

4. If questions arise concerning your report, whom should we contact?

Mr.
Mrs.
Miss ....
Name Title City State Area Code Tele. No.

PART II. REPORTING INSTRUCTIONS

The occupations listed in Part II of this form are grouped into broad functional categories and include most of the jobs that are likely to be found in the Reporting Unit's type of operation. Some of the listed occupations will not be found in every establishment of this type.

Please review the broad categories for an overall view of the kinds of occupations we are studying. Definitions of specific occupations within a group are provided in the enclosed "Booklet of Definitions." (Definitions are presented in "Definition Number" order. Use the Definition Number that appears in column (1) to easily locate the definition for any listed occupation.) Subtitles, shown in parenthesis, may follow some occupational titles. These represent many but not all of the different titles employers sometimes use for these occupations and are shown for illustrative purposes only.

Report each of your employees in one or the other of the listed occupations or ALL OTHER categories. Do not report a worker in more than one occupation.

Employees of the Reporting Unit should be counted in the occupations listed in Part II of this form on a **"Working As"** basis as of the date of the report, regardless of the occupational field in which they received their training. For example, an employee trained as an engineer but working as a mathematician as of the date of the report should be counted as a mathematician. An employee whose job duties cover more than one of the listed occupations should be counted in the occupation that, in your opinion, requires the highest level of skill.

- **Employees who were absent without pay** during the period being reported (i.e., short term absences resulting from illness, bad weather, temporary layoff, jury duty) should be included in the occupational counts.
- **Working Foremen** (those spending 20% or more of their time at tasks similar to those being performed by workers under their supervision) should be counted in the occupation most closely related to their work duties (e.g., a working foreman in an inspection department should be counted as an "Inspector").
- **Part-time Workers, Learners, and Apprentices** should be counted in the occupation in which they ordinarily perform their work.
- **Clerical Supervisors** should not be counted in any of the specific occupations. Instead, they should be counted in the most appropriate ALL OTHER category (e.g., a "Payroll Supervisor" should be counted in the ALL OTHER Office Clerical Worker Category).
- **Owners and partners** of unincorporated firms and unpaid family workers should be excluded from this report.

Include in this report, company personnel who perform their work duties at or "out of" **the reporting unit** but who, for administrative reasons, are carried on payrolls of other units of your company. For example, traveling salesmen or customer service personnel who work "out of" the reporting unit should be included in your report, even though these personnel may be carried on the rolls of another unit of your company.

Reasonable estimates of the number of workers you employ in an occupation are acceptable.

Description of Column Headings:

Column (3):	**This column is headed "TOTAL" and appears for every occupation. Enter in this column the total number of workers you employ in the listed occupations. If this is considered a critical shortage occupation, please circle the definition number.**
Column (4):	**This column is headed "Apprentice" and appears only with the "Maintenance, Construction, Repair and Powerplant" and selected "Production (Plant)" occupations. Enter in this column the number of apprentices, already reported in column (3), that you employ in any of these occupations. (See definition of apprentice on page 2 of the "Booklet of Definitions.")**
Column (5)	**This column is headed "R & D" (Research and Development) and appears only with scientific and technical occupations. Enter in this column the number of workers, already reported in column (3), who are working primarily in research and development activities. (See definition of research and development on page 2 of the "Booklet of Definitions.")**
Columns (6) and (7)	**Enter your estimate of the total number of your workers in reporting unit you expect to have in June, 1973, and in June, 1974. Assume: (1) a 4% national unemployment rate, (2) your current plans for expansion or modernization will materialize according to schedule, (3) scientific and technological changes affecting production methods, manpower requirements, and consumption patterns will continue according to industry expectations, and (4) the normal hourly workweek at your establishment will continue through the forecast period.**

The sum of the column (3) counts should be approximately equal to the "TOTAL EMPLOYMENT" reported in Part I of this form. (These may differ slightly because column (3) data may include employees on short term absence without pay.) If you do not employ anyone in a particular occupation leave column (3) blank.

SAMPLE ENTRIES

BEST COPY AVAILABLE

Definition number (1)	Occupations (2)	Total (3)	Apprentice (4)
	Maintenance, Construction, Repair and Power Plant Occupations		
	Carpenter	5	1
	Electrician	3	
	Production (Plant) Occupations		
	Foreman, nonworking	5	▨
	Inspector	10	▨

5 carpenters are employed. 1 of the 5 is an "apprentice." 3 electricians are employed. None are apprentices.

5 nonworking foremen are employed in "Production (Plant) occupations." 1 of the 5 is the inspection department foreman. 10 inspectors are employed. 1 is a "working" foreman and 1 is a "learner." Column (4) information on apprentices is not required for these occupations.

Definition number (1)	Occupations (2)	Total (3)	R & D (5)
	Managers and Officers		
	Manager, engineering	2	1
	Manager, scientific	1	
	ALL OTHER managers and officers	4	▨
	Professional Occupations Scientific		
	Engineers		
	Mechanical engineer	5	2
	Electrical and electronic engineer		
	Chemical engineer	2	
	ALL OTHER engineers	1	

7 managers and officers are employed. 2 of these manage engineering activities and 1 is the manager of the unit's chemical analysis department. The remaining 4 are non-technical (Controller, Sales Mgr., etc.) and are reported in the ALL OTHER category. 1 of the engineers is engaged in research and development activities.

8 engineers are employed (not counting Managers and Officers). 7 of these work in specifically listed engineering occupations. The remaining engineer is a "Mining Engineer," an occupation not specifically listed, and is reported in the ALL OTHER category. 2 of the 5 mechanical engineers are engaged in research and development activities.

Definition number (1)	Occupations (2)	Total (3)	Expected Employment in June 1973	Expected Employment in June 1974
	TECHNICAL OCCUPATIONS			
	Engineering Technicians			
	Draftsman	10	13	17

10 draftsman were employed as of May 1972. 13 are anticipated for June of 1973 (a net increase of 3) and 17 by June of 1974 (a net increase of 7)

PART II EMPLOYMENT BY OCCUPATIONS – PRINTING & PUBLISHING INDUSTRY

Definition number (1)	Occupation (2)	Total (3)	Expected Employment In June, 1973 (6)	Expected Employment In June, 1974 (7)
1.000	**EMPLOYMENT IN ALL OCCUPATIONS, TOTAL**			
2.000	**MANAGERS AND OFFICIALS, TOTAL**			
3.000	**PROFESSIONAL AND TECHNICAL WORKERS, TOTAL**			
3.010	Accountants and auditors			
3.020	Commercial artist (illustrator, editorial artist, art layout man)			
3.030	Commercial designer (bank note, book cover, form designer)			
3.040	Engineer (electrical, industrial, mechanical, chemical engineer)			
3.050	Estimator			
3.060	Mathematical scientist (mathematician, statistician, actuary)			
3.070	Natural sicentist (chemist, physcist, biological scientist, geologist)			
3.080	Personnel and labor relations specialists (employment interviewer, job analyst)			
3.090	Photographer			
3.100	Purchasing agent			
3.110	Social scientist (economist, political scientist, pyschologist, sociologist)			
3.120	Systems analyst, electronic data processing			
3.130	Writers, editors, and reporters (copy writer, rewrite man, deskman, advertising editor)			
3.140	All other professional workers (physician, lawyer, architect, professional nurse, reference librarian)			
3.150	Technicians			
3.151	Computer programer			
3.152	Draftsman			
3.153	Electrical and electronic technicians			
3.154	All other technicians			
4.000	**SALESMEN (ADVERTISING, CIRCULATION, BOOK, PRINTING SERVICES SALESMEN)**			
5.000	**CLERICAL WORKERS, TOTAL**			
5.010	Accounting clerk			

PART II EMPLOYMENT BY OCCUPATIONS – PRINTING & PUBLISHING INDUSTRY

Definition number (1)	Occupation (2)	Total (3)	Expected Employment In June 1973 (6)	Expected Employment In June 1974 (7)
5.020	Bookkeeper			
5.030	Cashier			
5.040	Classified-ad clerk, newspaper			
5.050	Correspondence clerk			
5.060	Customer service representative (customer liaison man)			
5.070	Invoice-control clerk			
5.080	Office machine operators, total			
5.081	Billing and/or bookkeeping-machine operator			
5.082	Digital-computer operator (computer console operator)			
5.083	Keypunch operator			
5.084	All other office machine operators, (calculating, duplicating, tabulating machine operators)			
5.090	Payroll clerk			
5.100	Personnel clerk			
5.110	Procurement clerk (purchasing clerk)			
5.120	Telephone ad-taker, newspaper			
5.130	Telephone operator (switchboard operator, PBX operator)			
5.140	Secretaries, stenographers, and typists, total			
5.141	Secretary			
5.142	Stenographer			
5.143	Typist (clerk-typist)			
5.150	All other clerical workers			
6.000	**PRODUCTION, MAINTENANCE, MATERIAL MOVEMENT, AND POWERPLANT WORKERS, TOTAL**			
	APPRENTICES *(Exclude learners and helpers)*			
6.010	Apprentice bookbinder			
6.020	Apprentice compositors and typesetters (hand compositor, Linecasting-machine operator, phototypesetter operator)			
6.030	Apprentice electrotyper			
6.040	Apprentice etchers and engravers, except photoengravers			
6.050	Apprentice lithographic preparation worker (cameraman, platemaker, stripper)			

PART II EMPLOYMENT BY OCCUPATIONS – PRINTING & PUBLISHING INDUSTRY

Definition number (1)	Occupation (2)	Total (3)	Expected Employment In June 1973 (6)	Expected Employment In June 1974 (7)
6.060	Apprentice photoengraver			
6.070	Apprentice pressman (letter pressman, gravure pressman, offset-lithographic pressman)			
6.080	Apprentice sterotyper			
6.090	Apprentices, all other printing trades (mailer, screen printer)			
6.100	Apprentices, all other (electrician, machinist, stationary engineer)			
	COMPOSING ROOM OCCUPATIONS			
6.110	Copy cutter (copy fitter)			
6.120	Hand compositor			
6.130	Imposers and makeup men (lockup man, stone hand)			
6.140	Linecasting machine operator (linotype operator, intertype operator)			
6.150	Linecasting machine keyboard operator (teletypesetter perforator operator)			
6.160	Linecasting machine tender (teletypesetting machine monitor)			
6.170	Ludlow-machine operator (nebitype operator)			
6.180	Mark-up man			
6.190	Monotype - casting machine operator (monomatic caster)			
6.200	Monotype-keyboard operator (monotype keyboard operator)			
6.210	Pasteup man			
6.220	Photolettering machine operater			
6.230	Phototypesetting-machine keyboard operator (photographic keyboard operator)			
6.240	Phototypesetting-machine monitor (photographic unit operator)			
6.250	Phototype setter operator (photographic system operator)			
6.260	Proofreader, composing room			
6.270	Strike-on machine operator			
	LITHOGRAPHIC - PHOTOMECHANICAL PREPARATION OCCUPATIONS			
6.280	Artist (retourcher, dot etcher, letterer, color etcher)			

PART II EMPLOYMENT BY OCCUPATIONS – PRINTING & PUBLISHING INDUSTRY

Definition number (1)	Occupation (2)	Total (3)	Expected Employment In June 1973 (6)	Expected Employment In June 1974 (7)
6.290	Cameraman (copy cameraman, photo lithographer, half-tone cameram. ———————————			
6.300	Developer (dark room man) ———————————			
6.310	Platemaker (press platemaker, transferrer) ————————			
6.320	Stripper ———————————			
	OTHER PLATEMAKING OCCUPATIONS			
6.330	Electrotyper (electrotype caster, electrotype molder) ———			
6.340	Etchers and engravers, except photoengravers (pantographer, siderographer, steel die engraver, letter engraver) —			
6.350	Photoengraver (cameraman, printer, etcher, router, blocker, finisher) ———————————			
6.360	Stereotyper ———————————			
	PRESSROOM OCCUPATIONS			
6.370	Flexographic pressman ———————————			
6.380	Gravure pressman, rotogravure and sheet fed ———————			
6.390	Letter pressman, sheet fed and roll fed (web fed) —————			
6.400	Letterset pressman (dry offset, indirect relief), sheet fed and roll fed (web fed) ———————————			
6.410	Offset lithographic pressman, sheet fed and roll fed (web fed) ———————————			
6.420	Steel die pressman (die stamping, steel die embossing pressman) ———————————			
6.430	Press assistants and feeders ———————————			
	SCREEN PROCESS OCCUPATIONS			
6.440	Screen cutter (stencil cutter, film cutter) —————————			
6.450	Screenmaker, photographic process ———————————			
6.460	Screen printer ———————————			
	BINDING, MAILING, and SHIPPING OCCUPATIONS			
6.470	Bindery machine setup man ———————————			

PART II EMPLOYMENT BY OCCUPATIONS – PRINTING & PUBLISHING INDUSTRY

Definition number (1)	Occupation (2)	Total (3)	Expected Employment In June, 1973 (6)	Expected Employment In June, 1974 (7)
6.480	Bindery worker (bindery hand, bindery man or woman, table worker)			
6.490	Bookbinder			
6.500	Deliveryman			
6.510	Mailer			
6.520	Routeman, newspaper (route supervisor)			
6.530	Shipping and/or receiving clerk			
6.540	Truckdriver, light or heavy			
	CONSTRUCTION, MAINTENANCE, REPAIR and POWERPLANT OCCUPATIONS			
6.550	Carpenter			
6.560	Electrician			
6.570	Machinist (composing room machinist, press room machinist)			
6.580	Mechanic, automotive			
6.590	Mechanic, general			
6.600	Mechanic, maintenance			
6.610	Mechanics and repairmen, other			
6.620	Plumber and/or pipefitter			
6.630	Stationary engineer			
	ALL OTHER PRODUCTION, MAINTENANCE, MATERIAL MOVEMENT, and POWERPLANT OCCUPATIONS			
6.640	Foreman, nonworking			
6.650	All other skilled craftsmen and kindred workers			
6.660	All other operatives and semiskilled workers (power truckdriver, inkman, paper conditioner, paper cutter, proof press operator)			
6.670	All other laborers and unskilled workers (warehousemen, press cleaner, paper handler, fly boy, groudkeeper, etc.)			
7.000	**SERVICE WORKERS, TOTAL**			
7.010	Guards, watchmen and doorkeepers			
7.020	Janitors, porters and cleaners			
7.030	All other service workers			

OKLAHOMA QUESTIONNAIRE

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SERVICE SCHEDULE

OKLAHOMA OCCUPATIONAL NEEDS
SURVEY QUESTIONNAIRE

Do Not Use This Space

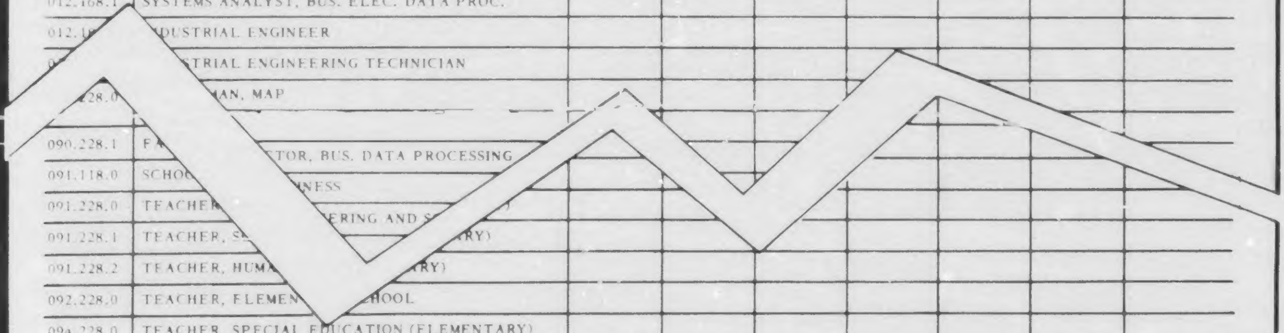
Editor________ Date ________

Return to:

Oklahoma State Employment Service
Research and Planning Division
Will Rogers Memorial Office Building
Oklahoma City, Oklahoma 73105
521-3735 Area Code 405

NOTE: Before Entering the Requested Information, Please Read the Instructions Attached to This Schedule.

D.O.T. CODE	OCCUPATION	EMPLOYMENT, EXCLUDING TRAINEES JUNE 1971		EXPECTED EMPLOYMENT IN		NUMBER OF WORKERS COMPLETING IN-PLANT TRAINING PROGRAMS BY		NUMBER OF VACANCIES UNFILLED 30 DAYS OR MORE
		TOTAL	FEMALE	JUNE 1973	JUNE 1975	JUNE 1973	JUNE 1975	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	PROFESSIONAL, TECHNICAL AND MANAGERIAL OCCUPATIONS							
001.081.0	ARCHITECT							
001.281.0	DRAFTSMAN, ARCHITECTURAL							
003.081.0	ELECTRICAL ENGINEER							
003.081.1	ELECTRONIC ENGINEER							
003.181.0	ELECTRICAL TECHNICIAN							
003.181.1	ELECTRONIC TECHNICIAN							
003.281.0	DRAFTSMAN, ELECTRICAL OR ELECTRONIC							
005.081.0	CIVIL ENGINEER							
005.181.0	CIVIL ENGINEERING TECHNICIAN							
005.281.0	DRAFTSMAN, CIVIL							
007.081.0	MECHANICAL ENGINEER							
007.181.0	MECHANICAL ENGINEERING TECHNICIAN							
007.281.0	DRAFTSMAN, MECHANICAL							
010.081.0	PETROLEUM ENGINEER							
010.281.0	DRAFTSMAN, GEOLOGICAL							
012.168.1	SYSTEMS ANALYST, BUS. ELEC. DATA PROC.							
012.1	DUSTRIAL ENGINEER							
0	STRIAL ENGINEERING TECHNICIAN							
228.0	MAN, MAP							
090.228.1	FA TOR, BUS. DATA PROCESSING							
091.118.0	SCHOO NESS							
091.228.0	TEACHER ERING AND S)							
091.228.1	TEACHER, S RY)							
091.228.2	TEACHER, HUMA RY)							
092.228.0	TEACHER, ELEMEN HOOL							
094.228.0	TEACHER, SPECIAL EDUCATION (ELEMENTARY)							
094.228.1	TEACHER, SPECIAL EDUCATION (SECONDARY)							
100.168.0	LIBRARIAN							
132.088.0	COPY WRITER							



(CONTINUED ON REVERSE SIDE)

SERVICE SCHEDULE (Cont.)

D. O. T. CODE	OCCUPATION	EMPLOYMENT, EXCLUDING TRAINEES JUNE 1971		EXPECTED EMPLOYMENT IN		NUMBER OF WORKERS COMPLETING IN-PLANT TRAINING PROGRAMS BY:		NUMBER OF VACANCIES UNFILLED 30 DAYS OR MORE
		TOTAL	FEMALE	JUNE 1973	JUNE 1975	JUNE 1973	JUNE 1975	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	PROFESSIONAL, TECHNICAL AND MANAGERIAL OCCUPATIONS (Cont.)							
132.288.0	COPY READER OR SCRIPT READER							
139.288.0	WRITER, TECHNICAL PUBLICATIONS							
141.081.0	ILLUSTRATOR, COMMERCIAL ARTIST							
141.081.1	LAYOUT MAN (PRINTING AND PUBLISHING)							
143.062.0	PHOTOGRAPHER OR CAMERA MAN							
160.188.0	ACCOUNTANT							
160.288.0	COST ESTIMATOR							
165.068.0	PUBLIC RELATIONS MAN							
166.118.0	PERSONNEL DIRECTOR							
168.168.0	CREDIT MANAGER							
189.168.0	MANAGEMENT TRAINEE							
	CLERICAL AND SALES OCCUPATIONS							
201.368.0	SECRETARY							
202.388.0	STENOGRAPHER							
205.368.0	PERSONNEL CLERK							
209.388.0	CLERK-TYPIST							
210.388.0	BOOKKEEPER, HAND							
211.368.0	CASHIER							
213.382.0	CARD-TAPE CONVERTER OPERATOR							
213.382.1	DIGITAL COMPUTER OPERATOR							
213.582.0	KEY-PUNCH OPERATOR							
213.782.0	TABULATING MACHINE OPERATOR							
215.388.0	BOOKKEEPING MACHINE OPERATOR							
215.488.0	PAYROLL CLERK							
219.388.0	CLERK, GENERAL OFFICE							
219.388.2	PROGRAMMER, DETAIL							
219.488.0	ACCOUNTING CLERK							
235.8[illegible]	TELEPHONE OPERATOR (P. B. X.)							
[illegible]	[illegible]M CLERK							
[illegible]	[illegible]MAN, SERVICES							
330.37[illegible]	[illegible]-DRIVER (ROUTEMAN)							
332.271.0	[illegible]							
	[illegible] SERVICE OCCUPATIONS							
359.678.0	N[illegible]							
372.868.0	SECU[illegible]RANT OR COFFEE SHO[illegible]							
382.884.0	CUSTOD[illegible]							
407.884.0	GROUNDSKE[illegible]							
461.885.0	GINNER							
466.887.0	LIVESTOCK CARE[illegible]KER							
	PROCESSING OCCUPATIONS							
521.782.0	GRINDER OPERATOR (GRAIN AND FEED MILL)							
526.781.0	BAKER							

(CONTINUED ON PAGE 3)

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Editor ________ Date ________

SERVICE SCHEDULE (Cont.)

Return to

Oklahoma State Employment Service
Research and Planning Division
Will Rogers Memorial Office Building
Oklahoma City, Oklahoma 73105
521-3735 Area Code 405

NOTE: *Before Entering the Requested Information, Please Read the Instructions Attached to This Schedule.*

D.O.T. CODE	OCCUPATION	EMPLOYMENT, EXCLUDING TRAINEES JUNE 1971		EXPECTED EMPLOYMENT IN		NUMBER OF WORKERS COMPLETING IN-PLANT TRAINING PROGRAMS BY		NUMBER OF VACANCIES UNFILLED 30 DAYS OR MORE
		TOTAL	FEMALE	JUNE 1973	JUNE 1975	JUNE 1973	JUNE 1975	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	MACHINE TRADES OCCUPATIONS							
620.281.0	AUTOMOBILE MECHANIC							
620.281.1	AIR CONDITIONING MECHANIC, AUTO.							
623.281.0	OUTBOARD MOTOR MECHANIC							
624.281.0	FARM EQUIPMENT MECHANIC							
625.281.0	DIESEL MECHANIC							
625.281.1	SMALL ENGINE REPAIRMAN							
633.281.0	OFFICE MACHINE SERVICEMAN							
651.782.1	OFFSET PRESSMAN							
	BENCHWORK OCCUPATIONS							
720.281.0	RADIO AND TELEVISION REPAIRMAN							
721.281.0	ELECTRIC MOTOR REPAIRMAN							
723.884.0	APPLIANCE REPAIRMAN, HOUSEHOLD							
763.381.0	FURNITURE FINISHER							
780.381.0	FURNITURE UPHOLSTERER							
785.381.0	SEAMSTRESS							
	STRUCTURAL WORK OCCUPATIONS							
807.	AUTOMOBILE BODY REPAIRMAN							
	DER, ARC							
	R, GAS							
000,000.	OMBINATION							
	OBILE							
	BUILDING							
	[illegible]							

SIGNATURE ____________________ DATE __________

Representative Completing This Report

TITLE ____________________ PHONE __________

APPENDIX E

RESURVEY METHODOLOGY

RESURVEY METHODOLOGY

The nucleus of the entire OTIS system is the interface of projected manpower demand with estimated manpower supply. The forecasts of manpower demand are employer-based. Therefore, an assessment of the accuracy of these employer forecasts is crucial to an evaluation of the OTIS demand data collection methodology. Consequently, the Project Monitoring Committee decided to survey 500 employers who participated in the Oklahoma and Kentucky OTIS surveys.

This appendix describes the resurvey data collection methodology, including:

- Sample selection
- Interviewer training
- Data collection
- Data processing

1. SAMPLE SELECTION

The OTIS surveys in Oklahoma and Kentucky were conducted to develop manpower demand forecasts for the entire state. Oklahoma utilized a sample of employers and Kentucky attempted a personal interview census. The purpose of the resurvey was to test the accuracy of the employer forecast and OTIS regional forecast by occupation. Therefore, our efforts focused on selecting a uniform resurvey sample. Sample selection in each state was conducted as follows.

(1) Kentucky Sample Selection

Kentucky attempted a census of manufacturing employers listed in the 1972 Directory of Manufacturers, published by the Kentucky Department of Commerce. As of September, 1973, the results of the survey were:

- 2,946 employers were in the universe
- 2,855 were contacted

- 374 were nonmanufacturers, who were thereby eliminated from the survey population
- 275 firms were determined to be inactive, i.e., out of business
- 69 employers refused to respond
- 61 employers were not contacted

Thus, a total of 2,175 usable responses exclusive of nonmanufacturing and inactive firms was received, giving an overall usable response rate of approximately 94 percent. Employers responding employ approximately 214,000 of the 234,500 manufacturing employees.

The resurvey sample also was selected from the 1972 Directory of Manufacturers as follows:

- Employers were classified into four groups, based on employment size
- The total number of employees in each group was estimated
- The sample (number of establishments) for each group was set proportional to the number of employees in each group

Using these procedures, a total of 600 establishments was selected. The number of establishments selected in each group is detailed in the following table:

Manufacturing Employers	Number of Establishments	Number Selected
First group (100+ employees)	520	388
Second group (50-99 employees)	281	79
Third group (20-49 employees)	526	65
Fourth group (under 20 employees)	1,353	68
Total	2,680	600

This sample was verified using the 1973 edition of the Directory of Manufacturers. Subsequently, the following categories of employers were eliminated:

- Inactive
- Noncooperative in first survey
- Nonmanufacturing and included in directory
- Failed to submit schedule

Discontinued operations, mergers, acquisitions, and other reasons reduced the sample to 486.

Subsequently, each company was identified by county and grouped by region.

- Each region was treated separately to assess the number of sites within each. Exhibit E-I, following this page, identifies the individual towns within a region and the number of employers per town.

- The regions were then grouped to identify the counties with the largest number of companies in each county. Exhibit E-II, following Exhibit E-I, identifies the seven counties having the largest number of companies per county.

- The final step involved the selection of actual companies to be resurveyed. Identification of a county cutoff point was related to the cost effective administration of the resurvey.

This process resulted in the selection of the 338 companies that are identified on the Scheduling Grid presented in Exhibit E-III, following Exhibit E-II. The 38 additional companies were included to provide for unforeseen problems in the field.

(2) Oklahoma Sample Selection

The original OTIS survey in Oklahoma was a sample of employers. The largest employers in terms of employment were contacted personally. The remaining firms receive survey questionnaires and are contacted only if an adequate response to the particular cell was not received.

EXHIBIT E-I

Economic Development Administration

NUMBER OF EMPLOYERS BY REGION AND TOWN

Region #1--29

Benton	2
Calvery City	2
Paducah	11
Wickliffe	1
Mayfield	4
Murray	3
Clinton	2
Farmington	1
Fulton	1
Arington	1
Lynn Grove	1

Region #2--32

Central City	3
Madisonville	3
Marion	1
Princeton	4
Hopkinsville	9
Dawson Springs	2
Guthrie	2
Kuttawa	1
Grand Rivers	1
Greenville	1
Elkton	2
Cadiz	3

Region #3--32

Maco	1
Henderson	11
Lewisport	1
Beaver Dam	2
Hawesville	1
Hartford	1
Morganfield	1
Fordsville	1
Ownesboro	11
Providence	1
Sebree	1

Region #4--43

Russelville	5
Bowling Green	10
Glasgow	7
Munfordville	1
Horse Cave	1
Tompkinsville	2
Franklin	5
Bonnieville	1
Gamaliel	1
Adairville	2
Cave City	1
Auburn	2
Morgantown	2
Scottsville	3

Region #5--21

Springfield	2
Barastown	3
Hodgenville	1
Lebanon	3
Leitchfield	2
Loretto	1
Hardinsburg	1
Elizabethtown	6
Brandenburg	1
Boston	1

Region #6--134

Shelbyville	4
Simpsonville	1
Louisville	113
Shepherdsville	1
Eminence	2
Mayfield	3
Marion	1
Mt. Washington	1
La Grange	2
Jeffersontown	2
Clermont	1
Buckner	1
Bagdad	1
New Castle	1

Region #7--32

Covington	10
Ludlow	2
Newport	3
Walton	1
Florence	9
Dry Ridge	1
Falmouth	1
Earlanger	2
Carrollton	2
Burler	1

Region #8--6

Mayesville	4
Flemingsburg	1
Vance Burg	1

Region #9--6

Morehead	3
West Liberty	1
Mt. Sterling	2

Region #10--16

Ashland	8
Hitchins	1
Catlettsburg	2
South Shore	1
Olive Hill	3
Lawton	1

Region #11--5

Paintsville	1
Whitesburg	1
Prestonsburg	1
Lackey	1
Auxier	1

Region #12--3

Hazard	1
Jackson	1
Beattyville	1

Region #13--19

Corbin	4
Middlesboro	6
Williamsburg	2
London	4
Harlan	2
Evarts	1

Region #14--25

Burnside	2
Albany	1
Somerset	5
Sterns	1
Summersville	1
Monticello	1
Pine Knot	1
Liberty	3
Greensburg	2
Dunnville	1
Ferguson	1
Campbellsville	5
Colombia	1

Region #15--83

Winchester	6
Richmond	6
Nicholasville	1
Paris	2
Lancaster	1
Lawrenceburg	3
Lexington	26
Franfort	8
Danville	6
Georgetown	5
Berea	3
Carlisle	1
Burgin	1
Harrodsburg	2
Irvine	1
Stanford	1
Stanton	2
Versailles	3
Cynthiana	5

EXHIBIT E-II

Economic Development Administration

KENTUCKY SCHEDULING GRID

Region	Companies By County (Largest)							Total
# 1	11	4	3	2	2	2	1	25
# 2	9	4	3	3	3	2	2	26
# 3	11	11	2	1	1	1	1	28
# 4	10	7	5	5	3	2	2	34
# 5	6	3	3	2	2	1	1	18
# 6	113	4	3	2	2	2	1	127
# 7	10	9	3	2	2	2	1	29
# 8	4	1	1	-	-	-	-	6
# 9	3	2	1	-	-	-	-	6
#10	8	3	2	1	1	1	-	16
#11	1	1	1	1	1	-	-	5
#12	1	1	1	-	-	-	-	3
#13	6	4	4	2	2	1	-	19
#14	5	5	3	2	2	1	1	19
#15	26	8	6	6	6	5	5	62
Subtotals:	224	67	41	29	27	20	15	423*

---

* This number is less than 486 because of counties falling outside the chart.

EXHIBIT E-III

Economic Development Administration

KENTUCKY EMPLOYER DISTRIBUTION

Region # 1	11	4					
# 2	9	4	3	3	3		
# 3	11	11					
# 4	10	7	5	5	3		
# 5	6						
# 6	113	4	3	2	2		
# 7	10	9	3	2	2		
# 8	4						
# 9	3						
#10	8						
#11							
#12							
#13	6						
#14	5	5					
#15	26	8	6	6	6	5	5

Scheduled Companies--338

The 1971 sample was selected as follows:

- OESC records were utilized to identify all businesses that paid a wage to four or more workers in each of 20 weeks.
- The state was divided into 11 state-planning districts.
- The employers in each industry division in each district were ranked in descending order by total employment.
- The sample was selected as follows:
  - 100 percent of the first two quartiles
  - 20 percent of the third quartile
  - 5 percent of the fourth quartile
- The selected sample was adjusted to include noncovered firms and major employers not otherwise included in the sample stratification.

Overall, the Oklahoma sample included 416 manufacturing and 2,217 non-manufacturing establishments employing approximately 375,000 people. The response rate for the sample was approximately 70 percent, or 1,865 reporting units.

Due to confidentiality constraints, the names of the employers participating in the Oklahoma survey and the number of employees in each firm were not available to MSI. Therefore, the Oklahoma sample was selected from a universe of all establishments in the original sample, whether they participated in the OTIS survey or not. Establishments were selected as follows:

- Government establishments were eliminated.
- Counties were grouped into seven geographic regions.
- Within each region, the counties were listed in descending order by number of establishments.
- All counties with 40 or more establishments and a systematic sample (every nth company) of other counties within each region were selected for sampling.
- Within each selected county, a systematic sample (every nth company) was drawn.

Using the above procedures, a total of 530 establishments was selected. The regional and county breakdown is discussed in Exhibit E-IV, following this page. Subsequently, at the request of the Project Monitoring Committee, an oversample of 200 firms was selected using similar techniques. This brought the total number of firms to 730.

2. TRAINING INTERVIEWERS

The resurvey interviewers were all college graduates with prior consulting experience or trained professional surveyors. All interviewers were trained prior to field work. The training included:

- An explanation of OTIS
- A description of manpower forecasting concepts
- An evaluation of the survey documents
- A description of the various occupations
- Practice interview procedures

3. DATA COLLECTION

The actual resurvey was conducted differently in Oklahoma and Kentucky. Each of these resurveys is discussed subsequently.

(1) Oklahoma Resurvey

Due to confidentiality constraints, the first step in the Oklahoma resurvey was to obtain permission from participating employers to utilize the survey questionnaires completed as part of the OTIS survey conducted by OESC. Waivers were asked from all employers in the OESC sample universe. The waiver requests and form are included in Exhibits V and VI, following Exhibit IV.

After a waiver was received, OESC released the original survey document for use in the resurvey. Many companies in the resurvey sample were eliminated because they did not participate in the original survey, would not cooperate in the resurvey, or because interviews could not be scheduled during the survey time period. The resurvey included approximately 250 firms.

Each interviewer was given a resurvey document prepared from the original survey document, and an introductory guide. The guide and a sample resurvey document are included in Exhibits VII and VIII, following Exhibit VI. Using the revised OTIS form, the interviewer:

EXHIBIT E-IV

Economic Development Administration

NUMBER OF EMPLOYERS BY RESURVEY
REGION, COUNTY, AND TOWN

Region	County	Number Of Establishment Sampled
I	Garfield	18
	Kay	16
	Kingfisher	10
	Texas	10
	Woods	10
	Grant	5
	Cherokee	5
	Ellis	5
II	Comanche	10
	Custer	12
	Grady	12
	Kiowa	7
	Tillman	5
	Harmon	5
III	Carter	12
	Pohawatomie	10
	Garvin	8
	Payne	12
	Bryan	12
	Murray	9
	Coal	5
	Okfuskee	5
	Pototoc	5
IV	Muskogee	16
	Washington	16
	Ohawa	10
	Okmilgee	10
	Craig	15
	Sequoyah	10
	Mc Intosh	6
	Nowata	5
	Delaware	5
V	Oklahoma	65
	Cleveland	16
	Logan	10
	Canadian	10
VI	Tulsa	55
	Creek	10
	Osage	10
VII	Pittsburg	15
	LeFlore	10
	Haskell	5
	Pushmatama	5

EXHIBIT E-V

Economic Development Administration

WAIVER LETTER

U.S. DEPARTMENT OF COMMERCE
Economic Development Administration

March 29, 1973

Dear Sir:

The Economic Development Administration has employed MACRO SYSTEMS, INC., to conduct an evaluation of the Occupational Training Information System (OTIS) currently operating in Oklahoma. The purpose of this evaluation is to determine the strengths and weaknesses of OTIS and to recommend improvements, where necessary. The results of this study should benefit all employers and employees in Oklahoma.

In order to conduct this research, the contractor requires assistance from all employers selected to participate in the original OTIS survey conducted by the Oklahoma Employment Security Commission (OESC) in the summer of 1971. Specifically, we need:

- Your permission to use the survey questionnaire which was completed by your company or branch operating in Oklahoma. OESC will only release the survey document if you will complete and forward the attached confidentiality release to MACRO SYSTEMS, INC. A stamped, self-addressed envelope is included for your convenience.
- Your present employment level by individual occupation code. After a review of your questionnaire, the contractor will contact you to ascertain your employment level. This will be done by a trained personnel specialist and should not require more than one half hour of your time.

The information is critical for the success of the evaluation, and all current data will be subject to the same confidentiality constraints as the original data.

Due to the short period of time available, we ask that you complete the release and return it as soon as possible. We believe the results of this study will be mutually beneficial. Consequently, we sincerely hope you will assist us in the effort.

Sincerely,

Herbert S Becker

Herbert S. Becker
Director, Office of Administration
and Program Analysis

Enclosure

EXHIBIT E-VI

Economic Development Administration

WAIVER FORM

I hereby authorize MACRO SYSTEMS, INC., to examine our 1971 OTIS questionnaire on file with the Oklahoma Employment Security Commission. I understand the data will remain confidential.

Signature

NAME:

TITLE:

COMPANY:

ADDRESS:

TELEPHONE NUMBER AND AREA CODE:

EXHIBIT E-VII

Economic Development Administration

OKLAHOMA OTIS SURVEY DESCRIPTION

- I am representing Macro Systems, Inc., under contract with the U. S. Department of Commerce, Economic Development Administration to study manpower forecasting techniques used by the Occupational Training Information System (OTIS) operating in Oklahoma.
- OTIS is a computer based information system designed to effectively supply the required trained manpower to the Oklahoma labor pool. The system is operated by the State Department of Vocational and Technical Education in Stillwater.
- This survey is essential to complete the study and should not require much time. The purpose of the study is to determine the current level of employment by specific occupation codes and is identical to the survey conducted during the summer of 1971.
- Any questions about our authority to conduct the survey should be referred to:

Mr. Will Bowman
Chief of Research and Planning
Oklahoma Employment Security Commission
Oklahoma City, Oklahoma

Telephone: Ac 405/521-3735

EXHIBIT E-VIII(1)

Economic Development Administration

SAMPLE RESURVEY FORM

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OMB # 41S73018
Approval Expires: 7/31/73

Do Not Use This Space
Editor ________ Date ________

FINANCE-INSURANCE-REAL ESTATE SCHEDULE
OKLAHOMA OCCUPATIONAL NEEDS
SURVEY QUESTIONNAIRE

Return to
Oklahoma State Employment Service
Research and Planning Division
Will Rogers Memorial Office Building
Oklahoma City, Oklahoma 73105
521-3735 Area Code 405

NOTE: *Before Entering the Requested Information, Please Read the Instructions Attached to This Schedule.*

D.O.T. CODE (1)	OCCUPATION (2)	Current Employment (3)	Prev. Forecasted Employment For June '73 (4)	Comments (Describe All Possible Variations) (5)
	PROFESSIONAL, TECHNICAL AND MANAGERIAL OCCUPATIONS			
012.168.1	SYSTEMS ANALYST, BUS. ELEC. DATA PROC.			
[illegible]	PROJECT DIRECTOR, BUS. DATA PROCESSING			
020.188.0	PROGRAMMER, BUSINESS			
02[illegible].188.[illegible]	STATISTICIAN, APPLIED			
050.088.0	ECONOMIST			
119.288.0	ABSTRACT CLERK (ABSTRACTOR)			
139.288.2	WRITER, TECHNICAL PUBLICATIONS			
160.188	ACCOUNTANT			
162.158.1	PURCHASING AGENT			
[illegible]	TITLE CLERK			
165.068.0	PUBLIC RELATIONS MAN			
166.118.0	PERSONNEL DIRECTOR			
166.168.0	SPECIAL AGENT (INSURANCE)			
168.168.0	CREDIT MANAGER			
168.168.1	SAFETY MAN (INSURANCE)			
168.287.0	BUILDING INSPECTOR			
168.288.0	CLAIM EXAMINER			
169.168.0	ESTATE PLANNER			
169.188.0	UNDERWRITER			
186.168.0	BANK CASHIER			
186.288.0	LOAN OFFICER			
189.168.0	MANAGEMENT TRAINEE			
191.287.0	APPRAISER, REAL ESTATE			
	CLERICAL AND SALES OCCUPATIONS			
201.368.0	SECRETARY			
202.388.0	STENOGRAPHER			
[illegible]	PERSONNEL CLERK			
[illegible]	CLERK-TYPIST			
[illegible]	STATEMENT CLERK			
[illegible]	BOOKKEEPER, HAND			
211.368.0	CASHIER			
[illegible]	TELLER, BANKING			
[illegible]	CARD-TAPE-CONVERTER OPERATOR			
[illegible]	DIGITAL COMPUTER OPERATOR			
[illegible]	KEY-PUNCH OPERATOR			
[illegible]	TABULATING MACHINE OPERATOR			
[illegible]	BOOKKEEPING MACHINE OPERATOR			
215.488.0	PAYROLL CLERK			
217.388.0	TRANSFER CLERK			
219.388.0	CLERK, GENERAL OFFICE			

(CONTINUED ON REVERSE SIDE)

EXHIBIT E-VIII(2)

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FINANCE-INSURANCE-REAL ESTATE SCHEDULE (Cont.)

D. O. T. CODE	OCCUPATION	Current Employment	Prev. Forecasted Employment For June '73	Comments (Describe All Possible Variations)
(1)	(2)	(3)	(4)	(5)
	CLERICAL AND SALES OCCUPATIONS (Cont.)			
219.388.2	PROGRAMMER, DETAIL			
219.388.[illegible]	SORTING CLERK			
219.488.0	ACCOUNTING CLERK			
235.862.0	TELEPHONE OPERATOR (P.B.X.)			
241.168.0	ADJUSTER (CLAIM ADJUSTER)			
219.368.0	CREDIT CLERK			
249.368.1	CLAIM CLERK (INSURANCE)			
•249.368.2	NEW ACCOUNT CLERK			
249.388.0	LOAN CLOSER			
250.258.0	SALESMAN, INSURANCE			
250.358.0	SALESMAN OR BROKER (REAL ESTATE)			
251.258.0	SALESMAN, SECURITIES			
	SERVICE OCCUPATIONS			
372.868.0	SECURITY GUARD (WATCHMAN)			
382.884.0	CUSTODIAN			
407.884.0	GROUNDSKEEPER			
	STRUCTURAL WORK OCCUPATIONS			
899.381.0	MAINTENANCE MAN, BUILDING			
	MISCELLANEOUS OCCUPATIONS			
950.782.0	ENGINEER, STATIONARY			
[illegible]	ALL REMAINING EMPLOYMENT (NOT SHOWN ABOVE)			
000.000.0	TOTAL EMPLOYMENT OF ESTABLISHMENT			

SIGNATURE ______________________________ DATE ______________

Representative Completing This Report

TITLE ______________________________ PHONE ______________

- Obtained current employment by occupation
- Compared forecasts and actual employment
- Attempted to ascertain the reasons for any discrepancies

Some of the reasons given for forecast errors are summarized below.

- Reasons for over forecasting:
  - Lost bid for work
  - Decreased work
  - Overhired
  - Eliminated one shift
  - Changed to subcontracts
- Reasons for under forecasting:
  - More business
  - New large contract
- Reasons for shifts in occupations:
  - Realigned duties
  - Error in original forecasts
  - Reclassified employees
  - Shifted work to another plant

(2) Kentucky Resurvey

Similar to Oklahoma, resurvey interviewers in Kentucky were given an introduction guide. The Kentucky guide is included in Exhibit IX, following this page. However, the actual data collection was conducted using printouts from the original OTIS survey. A sample printout is included in Exhibit X, following Exhibit IX. Using the printout, each interviewer:

- Obtained current employment by occupation
- Compared actual and forecast employment
- Sought to determine the reason for discrepancies

The reasons given for discrepancies included:

- Reasons for over forecasting:
  - Closed department
  - Business lagging

EXHIBIT E-IX

Economic Development Administration

KENTUCKY OTIS SURVEY DESCRIPTION

- Macro Systems, Inc. is under contract with the U. S. Department of Commerce, Economic Development Administration to study manpower forecasting techniques used by the Occupational Training Information System (OTIS) operating in Kentucky.

- OTIS is a computer based information system designed to effectively supply the required trained manpower to the Kentucky labor pool. The system is operated by the Kentucky Bureau of Vocational Education.

- This survey is essential to complete the study and should not require much time. The purpose of the study is to determine the current level of employment by specific occupation codes and is identical to the survey conducted last fall by the Bureau of Vocational Education (OTIS).

- Any questions about our authority to conduct the survey should be referred to:

Dr. J. Jones
Director of Information Services
Kentucky Bureau of Vocational Education
Frankfort, Kentucky

Telephone: 502/564-3096

EXHIBIT E-X(1)

Economic Development Administration

SAMPLE OTIS KENTUCKY PRINTOUT

```
                         THE KENTUCKY STATE DEPARTMENT OF EDUCATION
                              BUREAU OF VOCATIONAL EDUCATION
                                THE DEMAND MANPOWER SURVEY

                               EDIT ROSTER BY ESTABLISHMENT

STATE   KENTUCKY                                                              AS OF 03/29/73
REGION  06
COUNTY  056

          FIRM                INSTRUMENT                 SIC                  COLLECTION
          CODE                  NUMBER                   CODE                    DATE

      306900 0 00                190                     3433                   11/72

                                            PAGE 1 OF 1

 FIRM NAME               STREET ADDRESS       CITY NAME       ZIP       REPRESENTATIVE           PHONE


           ITEM        NUMBER         CS        NUMBER        NUMBER       EXPECTED       EXPECTED
           NUMBER      EMPLOYED                 APPRENTICE    NGD          JUNE NEXT      JUNE 2 YRS

           000         00000          0         *0000         0000         0000

           002         00003          0          0000         0000         0003           0003
           014         00001          0          0000         0000         0001           0001
           028         00019          0          0000         0000         0019           0019
           029         00007          0          0000         0000         0007           0007
           059         00033          0          0000         0000         0033           0033
           060         00029          0          0000         0000         0029           0029
           061         00012          0          0000         0000         0012           0012
           063         00004          0          0000         0000         0004           0004
           071         00002          0          0000         0000         0002           0002
           075         00000          0          0000         0000         0000           0000
           075         00018          0          0000         0006         0018           0018
           076         00007          0          0000         0000         0007           0007
           079         00003          0          0000         0000         0003           0003
           085         00005          0          0000         0000         0005           0005
           088         00005          0          0000         0000         0005           0005
           089         00013          0          0000         0000         0013           0013
           090         00006          0          0000         0000         0006           0006
           091         00018          0          0000         0000         0018           0018
           092         00001          0          0000         0000         0001           0001
           094         00000          0          0000         0000         0000           0000
           095         00000          0          0000         0000         0003           0000
           099         00003          0          0000         0000         0003           0003
           115         00001          0          0000         0000         0001           0001
           116         00001          0          0000         0000         0001           0001
           118         00001          0          0000         0000         0001           0001
           125         00001          0          0000         0000         0001           0001
           127         00003          0          0000         0000         0003           0003
```

EXHIBIT E-X(2)

THE KENTUCKY STATE DEPARTMENT OF EDUCATION
BUREAU OF VOCATIONAL EDUCATION
THE DEMAND MANPOWER SURVEY

EDIT ROSTER BY ESTABLISHMENT

	ITEM NUMBER	NUMBER EMPLOYED	CS	NUMBER APPRENTICE	NUMBER R&D	EXPECTED JUNE NEXT	EXPECTED JUNE 2 YRS
	139	00002	0	0000	0000	0002	0002
	141	00006	0	0000	0000	0006	0006
	144	00003	0	0000	0000	0003	0003
	148	00001	0	0000	0000	0001	0001
	150	00001	0	0000	0000	0001	0001
	152	00002	0	0000	0000	0002	0002
MANUAL TOTALS	999	•00456	0	•0102	•0000	•0228	•0228
MACHINE TOTALS		•00212	0	0000	•0006	•0212	•0212
DIFFERENCE		•00244	0	0102	•0008	•0016	•0016

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- Reasons for under forecasting:
  - Picked up new account
  - Opened new department
  - Added a shift
  - Bought another company
- Reasons for shifts in occupations:
  - New production lines
  - Change in production methods
  - Change in product line

4. DATA PROCESSING

The processing of the resurvey data included an initial edit, keypunching, computer editing, and a complete review of raw data prior to analyses. Each of these operations is described below.

(1) Initial Edit

As the resurvey documents were returned to MSI, they were individually reviewed for completeness and clarity. All data that were inadequate were sent back to the field and completed, if possible, or omitted from the resurvey, if still incomplete. After this initial edit, the documents were submitted for machine coding. The specifications utilized by EDA to maintain the original Kentucky OTIS data were utilized for coding the resurvey data of both states.

(2) Keypunching And Data Verification

The keypunching of the resurvey documents required over 8,000 cards. Because of the large volume of cards, the difficult nature of the keypunching, and the need for maximum accuracy, several test runs were developed to verify accuracy. After all discernable keypunch errors were removed, a line-by-line check of the data was initiated.

Each employer's survey document was matched against the computer printout for that company. The following data were checked on an individual line basis:

- Region

- Company name and address

- Resurvey date
- Survey document number
- Occupation line item code
  - Description
  - Original employment
  - Forecast employment
  - Actual employment
- Control totals

Only after these edits were complete were the data submitted to the Committee for review.

(3) Raw Data Check

Printouts of the resurvey data were submitted to representatives of the Project Monitoring Committee for review. These represented the resurvey data line item by line item and indicated potential problems and/or questions. Subsequently, the printouts were matched against the survey instruments and all questions reviewed with the EDA Project Officer. After this final review and a series of correction runs, the data were arrayed for analysis.

APPENDIX F

RESURVEY DATA ANALYSIS

RESURVEY DATA ANALYSIS

The resurvey of employers participating in the original OTIS survey in Oklahoma and Kentucky provided a comparison of actual and forecast employment by occupation for each resurveyed employer. These data were aggregated in different arrays to compare the actual and forecast employment by occupation by region and statewide. Consequently, it was necessary to select relevant statistics to test the forecast accuracy. After extensive analysis, the Project Monitoring Committee decided to use a set of three statistics to evaluate the accuracy of the OTIS demand data. Each of these statistics, including the derivation, limits, special cases, and interpretations, is described below.

1. U STATISTIC

The U Statistic was developed by Henri Theil[1] and has been used previously to evaluate the accuracy of employer forecast of manpower demand.[2] The formula for the U Statistic is:

$$U = \sqrt{\frac{\Sigma\left(P_i - A_i\right)^2}{\Sigma P_i^2}}$$

where P and A are the predicted employment change and actual employment change, respectively.

The U Statistic measures the seriousness of a given forecast error by its square. For example, the mean square prediction error for a set of n observations is:

$$\frac{1}{n} \sum_{i=1}^{n} \left(P_i - A_i\right)^2$$

The root mean square (RMS) prediction error is obtained by taking the square root of the above mean square prediction error. Thus, the RMS has the same dimensions as the predictions and realizations.

---

[1] Theil, Henri, Applied Economic Forecasting, Rand McNally & Company, Chicago, 1966.

[2] Moser, Collette H., An Evaluation Of Area Skill Surveys As A Basis For Manpower Policies, an unpublished doctoral dissertation at the University of Wisconsin, 1971.

APPENDIX F(2)

The U Statistic, or inequality coefficient of n pairs, is obtained by dividing the RMS prediction error by the square root of the mean successive difference of realizations. The result is the positive square root of:

$$U^2 = \sum_{i=1}^{n} \frac{\left(P_i - A_i\right)^2}{\Sigma A_i^2}$$

where P_i and A_i are predicted and actual changes in employment. Thus, $U=0$ only if the forecasts are all perfect, i.e., perfect for all occupations. Also, $U=1$ when the prediction procedure leads to the same RMS error as a naive no-change extrapolation. In summary, by using the inequality coefficient, one measures the seriousness of a prediction error by the quadratic loss criterion in such a way that the zero corresponds to perfection and the unit with the loss associated with a no-change extrapolation. It will be clear that the inequality coefficient has no finite upper bound, which is tantamount to saying that it is possible to do considerably worse than by extrapolating on a no-change basis. However, the U value of an incorrect no-change forecast is 1.0 regardless of the magnitude of the error because the original and forecast employment are equal.

For computational purposes, the U Statistic was reduced by substitutions, as follows:

$$U^2 = \frac{\sum_{i=1}^{n} \left(P_i - A_i\right)^2}{\sum_{i=1}^{n} A_i^2}$$

where P_i and A_i equal predicted and actual changes, respectively. It can be seen from this, that:

$$P_i = p - o$$

where p and o are predicted and original employment, respectively; and that

$$A_i = a - o$$

where a and o are the actual and original employment, respectively. Substitution shows that:

$$U^2 = \frac{\Sigma[(p - o) - (a - o)]^2}{\Sigma(a - o)^2}$$

$$= \frac{\Sigma(p - a)^2}{\Sigma(a - o)^2}$$

$$U = \sqrt{\frac{\Sigma(p - a)^2}{\Sigma(a - o)^2}}$$

Analysis of this formula indicates that several special cases can occur. When the actual level of employment determined by the resurvey is the same as the original level of employment, the denominator of the formula computes as zero. Since division by zero is undefined, the following criteria were selected if $a - o = 0$:

- If $\Sigma(p-a) = 0$ then U was set equal to zero, representing a perfect forecast.

- If $\Sigma(p-a) \neq 0$ then U was originally set to ∞ to correspond to the commonly accepted definition of a real number divided by zero. In order to complete regression computations, all cases of $U = \infty$ were redefined as 10.0. Logically, this means that an error value of ∞ percent was redefined to equal 1000 percent.

Another special case occurs when the numerator of the formula is zero. When this happens:

- If $\Sigma(a-o) = 0$ then U was set equal to zero as above.

- If $\Sigma(a-o) \neq 0$ then the U was set equal to zero. The basis for this was a perfect forecast being made as shown by $\Sigma(p-a)$ being zero.

2. STATISTIC I

Statistic I is a relatively simple statistic that relates the forecast error to total actual employment. The formula for this statistic is:

$$\text{Statistic I} = \frac{\text{Total Forecast - Total Actual}}{\text{Total Actual}}$$

Statistic I is computed using only total forecast and total actual employment of the employer or particular aggregation. Thus, errors in the individual occupational forecast comprising the total forecast can be offset.

Special cases occur when the employer either went out of business or forecasted going out of business. Those cases were handled as follows:

- If actual employment was zero or the company was out of business and the forecast employment was zero, then:

$$\text{Statistic I} = \frac{0-0}{0} = 0$$

- If actual employment was zero or the company was out of business and the forecast was positive, then:

$$\text{Statistic I} = \frac{x-0}{0} = \infty \quad \text{(reduced to 10.0)}$$

3. STATISTIC II

Statistic II relates the forecast error to the actual change in employment over the forecast period and is computed as follows:

$$\text{Statistic II} = \frac{\text{Total Forecast - Total Actual}}{\text{Total Actual - Total Original}}$$

Similar to Statistic I, this indicator allows canceling of internal errors and considers only total employment of the employer or other aggregation. In the case of a no-change forecast, Statistic II is always 1.0 because total forecasts employment equals total original employment.

Special cases occur as follows:

- If actual employment was zero and forecast employment was zero, then:

$$\text{Statistic II} = \frac{0-0}{0-x} = 0$$

- If actual employment was zero and forecast employment was not zero, then:

$$\text{Statistic II} = \frac{y-0}{0-x} = \text{real number}$$

- If forecast employment was zero and actual employment was not zero, then:

$$\text{Statistic II} = \frac{0-y}{y-x} = \frac{-y}{y-x} = \text{real number}$$

- If original employment equals actual employment, then:

$$\text{Statistic II} = \frac{y-x}{x-x} = \frac{y-x}{0} = \infty \quad \text{(reduced to 10.0)}$$

APPENDIX G

DISTRIBUTION BY REGION FOR EACH STATISTIC

APPENDIX G-1

Economic Development Administration

SAMPLE EMPLOYER PRINTOUT--
OKLAHOMA

```
                              OCCUPATIONAL TRAINING INFORMATION SYSTEM                      PAGE    28
                                   MACRO RESURVEY REPORT                              AS OF 20 DEC 73

STATE  OKLAHOMA     ORIGINAL SURVEY DATE  871   INSTRUMENT NO. 400         CURRENT EMPLOYMENT     238
REGION  2                  RESURVEY DATE  673          SIC CODE        OCCUPATIONAL CATEGORIES  44
                         FORECAST PERIOD   22

FIRM NAME                            STREET ADDRESS         CITY NAME          ZIP      REPRESENTATIVE               PHONE
•    319
DOT                               ORIGINAL    FORECAST ABS(FORECST FORECAST    ACTUAL-  ACTUAL    ABS(ACTUAL   ACTUAL-  ABS(ORIGINA
CODE   OCCUPATION                EMPLOYMENT  -ORIGINAL -ORIGINAL) EMPLOYMENT  FORECAST EMPLOYMENT -FORECAST)  ORIGINAL - ACTUAL)

3191380 FOOD SER SUPER                  3          0          0          3         0          3          0         0          0

3211380 HOUSEKEEP OCC                  16          0          0         16         0         16          0         0          0

3558780 NURSE AIDE-ORD                 64          0          0         84         0         64          0         0          0

3618850 LAUNDRY PER                     1          0          0          1         0          1          0         0          0

4076840 GROUNDSKEEPER                   1          0          0          1         0          1          0         0          0

8993810 MAINT MAN, BUILD                8          0          0          8         0          8          0         0          0

                       TOTAL          216         35         35        251       -13        238         25        22         32
                          USTAT =        .9369
                          STAT1 =        .0546
                          STAT2 =        .5909
```

APPENDIX G-II

Economic Development Administration

SAMPLE EMPLOYER PRINTOUT--
KENTUCKY

```
                           OCCUPATIONAL TRAINING INFORMATION SYSTEM                    PAGE   127
                                   MACRO RESURVEY REPORT                         AS OF 28 DEC 73

STATE  KENTUCKY    ORIGINAL SURVEY DATE  972   INSTRUMENT NO. 190        CURRENT EMPLOYMENT     679
REGION  4                  RESURVEY DATE  673          SIC CODE 3622  OCCUPATIONAL CATEGORIES  66
                          FORECAST PERIOD    9

FIRM NAME                          STREET ADDRESS          CITY NAME         ZIP       REPRESENTATIVE            PHONE


BLS                                ORIGINAL     FORECAST ABS(FORECST FORECAST     ACTUAL-   ACTUAL   ABS(ACTUAL    ACTUAL - ABS(ACTUAL
CODE    OCCUPATION                EMPLOYMENT  -ORIGINAL -ORIGINAL) EMPLOYMENT   FORECAST EMPLOYMENT -FORECAST)   ORIGINAL ORIGINAL)

61351   PAYROLL CLERK                    1         0         0         1           0         1         0           0         0

61352   PERSONNEL CLERK                  1         0         0         1           0         1         0           0         0

61353   PROCUREMENT CLERK                3         0         0         3           3         6         3           3         3

61331   ACCOUNTING CLERK                 5         0         0         5           1         6         1           1         1

61135   COMPUTER OPER                    2         0         0         2          -2         0         2          -2         2

61107   KEYPUNCH OPER                    7         0         0         7          -6         1         6          -6         6

61199   ALL OTH OFFC MACH OP             0         0         0         0           1         1         1           1         1

62033   PRODUCTION CLERK                42         1         1        43         -43         0        43         -42        42

62900   ALL OTH PLANT CLERKS             3         0         0         3          -3         0         3          -3         3

                      TOTAL            643        58        58       706         -22       679       358          36       336

U STATISTIC       .95971
STATISTIC 1       .03240 (FCST-ACT)/ACT
STATISTIC 2       .61111 (FCST-ACT)/(ACT-ORIG)
```

APPENDIX G-III

Economic Development Administration

DISTRIBUTION OF THE U STATISTIC BY REGION IN OKLAHOMA

Number of Employers With a U Statistic of:	Region 1	2	3	4	5	6	7	8	9	10	11	Total
0	-	2	1	-	2	4	1	5	-	-	-	15
.0001 - .1999	1	-	-	-	1	-	-	-	-	-	-	2
.2000 - .3999	-	-	-	-	-	-	-	2	-	1	-	3
.4000 - .5999	-	1	-	1	-	1	2	6	1	-	-	12
.6000 - .7999	-	1	1	3	-	2	-	4	2	-	-	13
.8000 - .9999	1	4	1	1	-	8	4	8	[illegible]	1	1	30
1.0000	4	3	1	6	7	16	10	16	1	5	3	72
1.0001 - 1.2500	-	2	-	-	1	7	3	5	-	-	1	19
1.2501 - 1.5000	1	1	1	-	-	5	2	1	-	-	2	13
1.5001 - 1.7500	-	-	-	-	-	1	-	1	-	-	-	2
1.7501 - 2.0000	-	-	2	-	-	-	-	-	1	-	-	3
Over 2.0000	1	2	-	-	1	-	-	4	-	-	1	9
Totals by Region	8	16	7	11	12	44	22	52	6	7	8	193

APPENDIX C-IV

Economic Development Administration

DISTRIBUTION OF STATISTIC I
BY REGION IN OKLAHOMA

	Number of Employers With a Statistic I of:	Region 1	2	3	4	5	6	7	8	9	10	11	Total
MINUS (-)	∞	--	--	--	--	--	--	--	1	--	--	--	1
	Over 1,000	--	--	--	--	--	--	--	--	--	--	--	--
	.901 - 1.000	--	--	--	--	--	1	--	--	--	--	--	1
	.801 - .900	--	--	--	--	--	3	--	--	--	--	--	3
	.701 - .800	--	--	--	--	--	--	--	--	--	--	--	--
	.601 - .700	--	1	--	--	--	--	--	--	--	--	--	1
	.501 - .600	--	--	--	--	--	2	--	2	--	--	--	4
	.451 - .500	--	--	--	--	--	--	--	--	--	--	--	--
	.401 - .450	--	1	--	--	--	--	1	1	--	--	--	3
	.351 - .400	--	--	--	--	--	1	1	--	--	--	--	2
	.301 - .350	--	--	--	1	--	--	--	1	--	1	--	3
	.251 - .300	--	--	1	1	--	--	1	1	1	--	--	5
	.201 - .250	--	2	--	--	1	1	1	1	--	--	--	6
	.151 - .200	--	--	--	1	--	2	--	4	1	1	--	9
	.101 - .150	--	2	--	1	--	1	2	1	--	1	--	8
	.051 - .100	2	1	1	2	--	6	1	4	--	--	1	18
	.001 - .050	--	2	--	2	2	5	2	8	--	1	1	23
	0	--	2	1	--	3	6	4	6	2	--	2	26
PLUS (+)	.001 - .050	1	1	--	--	1	6	3	6	1	2	--	21
	.051 - .100	1	1	1	--	2	1	1	3	--	--	2	12
	.101 - .150	2	1	--	--	1	1	--	6	--	--	1	12
	.151 - .200	--	2	--	2	--	2	--	1	--	--	--	7
	.201 - .250	1	--	1	--	--	1	1	3	--	--	--	7
	.251 - .300	--	--	--	--	--	1	--	1	--	--	--	2
	.301 - .350	--	--	--	--	--	2	--	--	--	--	--	2
	.351 - .400	--	--	--	--	--	1	1	--	--	--	--	2
	.401 - .450	--	--	--	--	--	--	--	1	--	--	--	1
	.451 - .500	--	--	1	1	--	--	1	--	--	--	--	3
	.501 - .600	--	--	--	--	--	--	1	--	--	--	1	2
	.601 - .700	--	--	1	--	--	--	--	--	--	--	--	1
	.701 - .800	--	--	--	--	--	1	--	--	--	--	--	1
	.801 - .900	--	--	--	--	1	--	--	--	1	--	--	2
	.901 - 1.000	--	--	--	--	--	--	1	--	--	1	--	2
	Over 1,000	1	--	--	--	1	--	--	1	--	--	--	3
	Totals by Region	8	16	7	11	12	44	22	52	6	7	8	193

APPENDIX G-V

Economic Development Administration

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DISTRIBUTION OF STATISTIC II
BY REGION IN OKLAHOMA

	Number of Employers With a Statistic II of:	Region											Total
		1	2	3	4	5	6	7	8	9	10	11	
MINUS (-)	∞	--	1	--	--	1	--	--	1	--	--	--	3
	Over 2,000	1	1	--	--	2	1	1	3	--	--	1	10
	1,751 - 2,000	--	--	--	--	--	1	--	--	--	--	2	3
	1,501 - 1,750	--	--	--	--	--	--	1	1	--	--	--	2
	1,251 - 1,500	--	--	--	--	--	2	--	2	1	--	--	5
	1,001 - 1,250	--	--	--	--	--	2	1	2	--	--	--	5
	.901 - 1,000	5	4	2	7	6	18	10	18	1	5	1	77
	.801 - .900	--	1	--	--	--	1	--	1	--	--	--	3
	.701 - .800	--	--	--	1	--	1	1	2	--	--	--	5
	.601 - .700	--	1	1	1	--	1	--	--	--	--	--	4
	.501 - .600	--	1	1	1	--	--	--	1	--	--	--	4
	.451 - .500	--	1	--	--	--	--	--	4	--	1	1	7
	.401 - .450	--	1	--	1	--	1	--	--	--	--	--	3
	.351 - .400	--	--	--	--	--	2	--	--	--	--	--	2
	.301 - .350	--	--	--	--	--	1	--	--	--	--	--	1
	.251 - .300	--	--	--	--	--	--	--	--	--	--	--	--
	.201 - .250	--	--	--	--	--	--	--	--	--	--	--	--
	.151 - .200	--	--	--	--	--	--	--	--	--	--	--	--
	.101 - .150	--	--	--	--	--	--	--	2	--	--	--	2
	.051 - .100	--	--	--	--	1	1	--	1	--	--	--	3
	.001 - .050	--	--	--	--	--	--	--	--	--	--	--	--
	0	--	2	1	--	2	7	4	6	2	--	2	26
PLUS (+)	.001 - .050	--	--	--	--	--	--	--	--	--	--	--	--
	.051 - .100	--	--	--	--	--	--	--	--	--	--	--	--
	.101 - .150	--	--	--	--	--	--	--	2	1	--	--	3
	.151 - .200	--	--	--	--	--	--	--	--	--	--	--	--
	.201 - .250	--	--	--	--	--	--	--	--	--	--	--	--
	.251 - .300	--	--	--	--	--	1	--	--	--	--	--	1
	.301 - .350	--	--	--	--	--	--	--	1	--	--	--	1
	.351 - .400	--	--	--	--	--	--	1	--	--	--	--	1
	.401 - .450	--	--	--	--	--	--	--	--	--	--	--	--
	.451 - .500	--	--	--	--	--	--	--	1	--	--	--	1
	.501 - .600	--	1	--	--	--	--	--	--	--	--	--	1
	.601 - .700	--	--	--	--	--	1	--	--	--	--	--	1
	.701 - .800	--	--	--	--	--	--	--	--	--	--	--	--
	.801 - .900	--	--	--	--	--	--	--	--	--	--	--	--
	.901 - 1,000	--	1	--	--	--	2	1	--	--	1	--	5
	1,001 - 1,250	--	--	--	--	--	--	1	1	--	--	--	2
	1,251 - 1,500	--	--	--	--	--	--	1	--	1	--	--	2
	1,501 - 1,750	--	1	--	--	--	1	--	--	--	--	--	2
	1,751 - 2,000	1	--	--	--	--	--	--	--	--	--	--	1
	Over 2,000	1	--	2	--	--	--	--		--	--	1	7
	Totals by Region	8	16	7	11	12	44	22	52	6	7	8	193

APPENDIX G-VI

Economic Development Administration

DISTRIBUTION OF THE U STATISTIC BY REGION IN KENTUCKY

Number of Employers With a U Statistic of:	Region												Total
	1	2	3	4	5	6	7	8	9	10	14	15	
0	1	5	4	-	1	16	2	1	1	1	-	1	33
.0001 - .1999	-	-	-	-	-	-	-	-	-	-	-	-	-
.2000 - .3999	-	-	-	-	-	-	-	-	-	1	-	1	2
.4000 - .5999	-	1	-	-	-	1	-	-	-	-	-	1	3
.6000 - .7999	1	1	-	2	-	2	1	-	-	-	1	1	9
.8000 - .9999	1	1	1	4	1	8	2	1	-	-	-	6	25
1.0000	1	8	11	11	2	64	11	-	2	1	6	20	137
1.0001 - 1.2500	3	2	3	2	-	10	8	2	-	3	1	15	49
1.2501 - 1.5000	1	1	1	1	-	5	3	-	-	-	-	3	15
1.5001 - 1.7500	-	-	1	1	-	1	-	-	-	-	-	1	4
1.7501 - 2.0000	1	-	2	-	-	1	1	-	-	1	-	1	7
Over 2.0000	-	-	3	2	1	2	3	-	-	-	1	5	17
Totals by Region	9	19	26	23	5	110	31	4	3	7	9	55	301

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APPENDIX G-VII

Economic Development Administration

DISTRIBUTION OF STATISTIC I
BY REGION IN KENTUCKY

	Number of Employers With a Statistic I of:	Region 1	2	3	4	5	6	7	8	9	10	14	15	Total
MINUS (-)	∞	--	--	1	--	--	2	--	--	--	--	--	--	3
	Over 1,000	--	--	--	--	--	--	--	--	--	--	--	--	--
	.901 - 1.000	--	--	--	--	--	--	--	--	--	--	--	--	--
	.801 - .900	--	--	--	--	--	--	--	--	--	--	--	--	--
	.701 - .800	--	--	--	--	--	--	--	--	--	--	--	--	--
	.601 - .700	--	--	--	--	--	--	--	--	--	--	--	1	1
	.501 - .600	1	--	--	--	--	--	--	--	--	--	1	1	3
	.451 - .500	--	--	--	--	--	2	--	--	--	--	--	--	2
	.401 - .450	--	--	--	1	--	--	--	--	--	--	--	--	1
	.351 - .400	--	--	1	--	--	3	--	--	--	--	--	1	5
	.301 - .350	--	--	--	--	--	1	1	--	1	--	--	--	3
	.251 - .300	--	1	--	--	--	2	2	--	--	--	1	2	8
	.201 - .250	--	--	--	2	--	1	1	--	--	--	2	2	8
	.151 - .200	1	--	--	1	1	1	--	--	--	--	--	--	4
	.101 - .150	--	1	1	1	1	7	1	--	--	--	--	3	15
	.051 - .100	--	6	--	2	--	11	3	1	--	--	2	1	26
	.001 - .050	1	--	2	1	--	18	4	--	--	--	--	10	36
	0	1	8	7	--	1	16	2	1	2	3	--	1	42
PLUS (+)	.001 - .050	--	--	--	3	--	15	2	--	--	2	--	5	27
	.051 - .100	--	--	3	2	--	14	4	1	--	--	--	8	32
	.101 - .150	2	1	2	1	1	3	4	--	--	1	1	4	20
	.151 - .200	1	--	3	3	--	3	1	--	--	--	--	--	11
	.201 - .250	--	1	--	--	--	1	1	1	--	1	--	2	7
	.251 - .300	--	--	3	2	--	--	1	--	--	--	--	5	11
	301 - .350	--	--	--	2	--	3	--	--	--	--	--	1	6
	.351 - .400	--	--	--	--	--	2	1	--	--	--	1	2	6
	.401 - .450	1	--	1	--	--	--	2	--	--	--	--	1	5
	.451 - .500	--	--	--	1	--	2	--	--	--	--	--	--	3
	.501 - .600	--	--	1	1	1	1	--	--	--	--	--	2	6
	.601 - .700	--	--	1	--	--	--	--	--	--	--	--	1	2
	.701 - .800	--	--	--	--	--	--	--	--	--	--	--	--	--
	.801 - .900	--	--	--	--	--	--	--	--	--	--	--	--	--
	.901 - 1.000	--	1	--	--	--	1	--	--	--	--	--	--	2
	Over 1.000	1	--	--	--	--	1	1	--	--	--	1	2	6
	Totals by Region	9	19	26	23	5	110	31	4	3	7	9	55	301

APPENDIX C-VIII

Economic Development Administration

DISTRIBUTION OF STATISTIC II BY REGION IN KENTUCKY

	Number of Employers With a Statistic II of:	Region												Total
		1	2	3	4	5	6	7	8	9	10	14	15	
MINUS (-)	∞	1	--	2	--	--	4	2	--	--	1	1	5	16
	Over 2,000	--	1	2	2	--	4	3	1	--	--	1	4	18
	1,751 - 2,000	--	--	--	1	--	2	--	1	--	--	--	3	7
	1,501 - 1,750	--	--	--	--	--	2	1	--	--	--	--	--	3
	1,251 - 1,500	2	--	1	1	--	1	1	--	--	--	--	--	6
	1,001 - 1,250	1	--	1	--	--	1	2	--	--	1	--	4	10
	.901 - 1,000	2	7	8	12	1	60	11	--	1	--	5	17	124
	.801 - .900	--	1	--	--	--	2	--	--	--	--	--	--	3
	.701 - .800	--	--	--	--	--	--	--	--	--	--	1	1	2
	.601 - .700	--	--	--	1	--	2	--	--	--	--	--	2	5
	.501 - .600	--	2	1	1	1	1	--	1	--	--	--	1	8
	.451 - .500	--	--	--	--	--	1	--	--	--	--	--	3	4
	.401 - .450	--	--	--	--	--	--	--	--	--	--	--	--	--
	.351 - .400	--	--	1	--	--	--	1	--	--	--	--	1	3
	.301 - .350	--	--	--	1	--	1	--	--	--	--	--	--	2
	.251 - .300	--	--	--	--	--	--	--	--	--	--	--	--	--
	.201 - .250	1	--	--	--	--	1	2	--	--	--	--	--	4
	.151 - .200	--	--	--	--	--	1	1	--	--	--	--	1	3
	.101 - .150	--	--	--	--	--	--	1	--	--	--	--	1	2
	.051 - .100	--	--	--	--	--	--	--	--	--	--	--	--	--
	.001 - .050	--	--	--	--	--	--	--	--	--	--	--	--	--
	0	1	8	7	--	1	16	2	1	2	3	--	1	42
PLUS (+)	.001 - .050	--	--	--	--	--	--	--	--	--	--	--	--	--
	.051 - .100	--	--	--	--	--	--	--	--	--	--	--	--	--
	.101 - .150	--	--	--	--	--	--	--	--	--	--	--	1	1
	.151 - .200	--	--	--	--	--	--	--	--	--	--	--	--	--
	.201 - .250	--	--	--	--	--	1	--	--	--	--	--	--	1
	.251 - .300	--	--	--	--	--	--	--	--	--	--	--	1	1
	.301 - .350	--	--	--	--	--	1	--	--	--	--	--	--	1
	.351 - .400	--	--	--	--	--	--	--	--	--	--	--	--	--
	.401 - .450	--	--	--	--	--	--	--	--	--	--	--	--	--
	.451 - .500	--	--	--	--	--	2	--	--	--	1	--	1	4
	.501 - .600	--	--	--	1	--	--	--	--	--	--	--	--	1
	.601 - .700	--	--	--	2	--	--	1	--	--	--	--	--	3
	.701 - .800	--	--	--	--	--	1	1	--	--	--	--	--	2
	.801 - .900	--	--	--	--	--	--	--	--	--	--	--	1	1
	.901 - 1.000	--	--	--	--	--	--	--	--	--	--	--	--	--
	1,001 - 1,250	--	--	--	--	--	--	--	--	--	--	--	--	--
	1,251 - 1,500	--	--	--	--	--	1	--	--	--	-	--	1	2
	1,501 - 1,750	--	--	1	--	--	--	--	--	--	--	--	--	1
	1,751 - 2,000	1	--	1	--	--	--	--	--	--	--	--	1	3
	Over 2,0000	--	--	1	1	2	5	2	--	--	1	1	5	18
	Totals by Region	9	19	26	23	5	110	31	4	3	7	9	55	301

APPENDIX H

RESURVEY SUMMARY DATA

OKLAHOMA

```
QUICK QUERY     DAVE PURTCH    AD-30          MACRO QQP TEST OK               MACRO.OK

SURVEY ORIGINAL   FORECAST   ACTUAL     FORECAST  U          STATISTIC  STATISTIC
       NUMBER     NUMBER     NUMBER     MINUS     STATISTIC  ONE        TWO
       EMPLOYEES  EMPLOYEES  EMPLOYEES  ORIGINAL

  500         15         15          0        0    1.00000   10.00000   -1.00000
  500          1          1          1        0     .00000     .00000     .00000
  300          1          1          1        0     .00000     .00000     .00000
  700          2          2          2        0     .00000     .00000     .00000
  700          3          3          4        0    1.00000   -.25000    -1.00000
  800          5          5          5        0     .00000     .00000     .00000
  900          4          4          5        0    1.00000   -.20000    -1.00000
  600          2          2          5        0    1.00000   -.60000    -1.00000
  900          7          7          6        0    1.00000     .16667   -1.00000
  600         12         12          6        0    1.00000    1.00000   -1.00000
  300          8          8          7        0    1.00000     .14286   -1.00000
  900          9          9          7        0    1.00000     .28571   -1.00000
  900          7          7          7        0     .00000     .00000     .00000
  500          1          1          8        0    1.00000   -.87500    -1.00000
  300         10         10          8        0    1.11803     .25000   -1.00000
  500          8          8          8        0     .00000     .00000     .00000
  800         10         10          9        0    1.00000     .11111   -1.00000
  800         10         10          9        0    1.00000     .11111   -1.00000
  300         11         11         10        0    1.00000     .10000   -1.00000
  900          9          9         10        0    1.00000   -.10000    -1.00000
  900          8          8         11        0    1.00000   -.27273    -1.00000
  700         13         13         13        0    1.00000     .00000     .00000
  800         16         16         13        0    1.00000     .23077   -1.00000
  900         17         17         17        0     .00000     .00000     .00000
  200         17         17         17        0    1.00000     .00000     .00000
  900         15         15         19        0    1.00000   -.21053    -1.00000
  300         16         16         19        0    1.00000   -.15789    -1.00000
  300         19         19         21        0    1.00000   -.09524    -1.00000
  300         20         20         23        0    1.00000   -.13043    -1.00000
  700         26         26         24        0     .86603     .08333   -1.00000
  500         35         35         24        0    1.00000     .45833   -1.00000
  900         30         30         25        0    1.00000     .20000   -1.00000
  900         38         38         25        0    1.00000     .52000   -1.00000
  500         26         26         26        0    1.00000     .00000     .00000
  400         30         30         29        0     .04709     .03448   -1.00000
  900         34         34         29        0    1.00000     .17241   -1.00000
  900         29         29         31        0    1.00000   -.06452    -1.00000
  900         29         29         34        0    1.00000   -.14706    -1.00000
  400         40         40         35        0    1.00000     .14286   -1.00000
  200         29         29         37        0    1.00000   -.21622    -1.00000
  800         38         38         38        0    1.00000     .00000     .00000
  500         33         33         39        0    1.00000   -.15385    -1.00000
  100         33         33         40        0    1.00000   -.17500    -1.00000
  500          1          1         43        0    1.00000   -.97674    -1.00000
  900         45         45         44        0    1.00000     .02273   -1.00000
  300         44         44         49        0    1.00000   -.10204    -1.00000
  800         50         50         50        0     .00000     .00000     .00000
  300         32         32         50        0    1.00000   -.36000    -1.00000
  900         48         48         50        0    1.00000   -.04000    -1.00000
  300         47         47         52        0    1.00000   -.09615    -1.00000
  900         57         57         52        0    1.00000     .09615   -1.00000
  300         49         49         52        0    1.00000   -.05769    -1.00000
```

BEST COPY AVAILABLE

APPENDIX H-I(2)

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QUICK QUERY    DAVE PORTCH    AD-30          MACRO QQP TEST OK             MACRO.OK

SURVEY ORIGINAL   FORECAST    ACTUAL      FORECAST    U            STATISTIC   STATISTIC
       NUMBER     NUMBER      NUMBER      MINUS       STATISTIC    ONE         TWO
       EMPLOYEES  EMPLOYEES   EMPLOYEES   ORIGINAL

  100        50          50          52           0     1.00000     -.03646    -1.00000
  900         8           8          54           0     1.00000     -.85165    -1.00000
  900        55          55          56           0     1.00000     -.05172    -1.00000
  900        54          64          56           0     1.00000     -.06697    -1.00000
  600        72          72          65           0     1.00000      .10769    -1.00000
  500        66          66          66           0     1.00000      .00000      .00000
  800        83          63          67           0     1.00000      .23881    -1.00000
  300        76          76          76           0      .00000      .00000      .00000
  500        79          79          80           0     1.00000     -.01250    -1.00000
  900        69          69          80           0     1.00000     -.13750    -1.00000
  300        70          70          92           0     1.00000     -.23913    -1.00000
  900        98          98          94           0     1.00000      .04255    -1.00000
  900        95          95          98           0     1.00000     -.03061    -1.00000
  700       101         101         104           0     1.00000     -.02885    -1.00000
  400        79          79         104           0     1.00000     -.24038    -1.00000
  500       101         101         110           0     1.00000     -.08182    -1.00000
  900       111         111         113           0     1.00000     -.01770    -1.00000
  600       119         119         125           0     1.00000     -.04800    -1.00000
  900       131         131         130           0     1.00000      .00769    -1.00000
  200       195         195         132           0     1.00000      .47727    -1.00000
  700       134         134         134           0     1.00000      .00000      .00000
  100        85          85         135           0     1.00000     -.37037    -1.00000
  700       139         139         136           0     1.00000      .02206    -1.00000
  800       134         134         146           0     1.00000     -.08219    -1.00000
  500       258         258         151           0      .99098      .70861    -1.00000
  900       109         109         191           0     1.00000     -.42932    -1.00000
  400       200         200         193           0     1.00000      .03627    -1.00000
  700       195         195         198           0     1.00000     -.01515    -1.00000
  300       200         200         211           0     1.00000     -.05213    -1.00000
  200       115         115         242           0     1.00000     -.52479    -1.00000
  200       251         251         261           0     1.00000     -.03831    -1.00000
  700       290         290         286           0     1.00000      .01399    -1.00000
  900       428         428         407           0     1.00000      .05160    -1.00000
  900      1095        1095         770           0     1.00000      .42208    -1.00000
  300         1           3           3           2      .00000      .00000      .00000
  800        13          24           4          11     2.22222     5.00000    -2.22222
  200         4           6           5           2     2.23607      .20000     1.00000
  100         8          11           6           3     1.16484      .83333    -2.50000
  900        10           7           7          -3      .53452      .00000      .00000
  800         6          11           8           5     1.27475      .37500     1.50000
  900        10          11           8           1     1.35401      .37500    -1.50000
  100         6           8           8           2      .00000      .00000      .00000
  100        16          44          10          28     2.05913     3.40000    -5.66667
  300        17          22          10           5     1.57181     1.20000    -1.71429
  700        13          19          10           6     2.50454      .90000    -3.00000
  900        10          15          13           5      .81650      .15385      .66667
  900        12          14          13           2     1.00000      .07692     1.00000
  500        14          12          14          -2      .86603     -.14286    10.00000
  900        18          23          19           5     1.82574      .21053     4.00000
  900        18          19          19           1      .00000      .00000      .00000
  900        18          21          20           3      .50000      .05000      .50000
  800        20          23          20           3      .59761      .15000    10.00000
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QUICK QUERY    DAVE PORTCH   AD-30        MACRO QQP TEST OK          MACRO.OK

SURVEY ORIGINAL    FORECAST   ACTUAL     FORECAST   U           STATISTIC  STATISTIC
       NUMBER      NUMBER     NUMBER     MINUS      STATISTIC   ONE        TWO
       EMPLOYEES   EMPLOYEES  EMPLOYEES  ORIGINAL
  800      16         26         20       10     1.82574     .30000     1.50000
  500      31         32         26        1     1.20000     .23077    -1.20000
  900      51         53         27        2     1.00717     .96296    -1.08333
  700      22         24         28        2      .70711    -.14286     -.66667
  300      35         36         29        1     1.00995     .24138    -1.16667
  600      18         19         29        1      .93182    -.34483     -.90909
  300      30         31         29        1     1.41421     .06897    -2.00000
  900      25         27         30        2     1.13389    -.10000     -.60000
  300      28         29         30        1      .38188    -.03333     -.50000
  900      32         33         31        1     1.09545     .06452    -2.00000
  300      34         37         33        3     1.26491     .12121    -4.00000
  300      36         42         36        6      .93326     .16667    10.00000
  900      35         49         40       14     1.29099     .22500     1.80000
  400      51         23         40      -28     1.31056    -.42500     1.54545
  600      27         28         41        1      .99666    -.31707     -.92857
  700      43         44         45        1     1.11803    -.02222     -.50000
  600      31         46         48       15      .26608    -.04167     -.11765
  900      45         52         50        7      .96077     .04000      .40000
  300      45         48         51        3      .62678    -.05882     -.50000
  300      51         58         58        7      .61721     .00000      .00000
  300      56         63         59        7      .90267     .06780     1.33333
  300      49         60         60       11      .56796     .00000      .00000
  300      54         58         66        4     1.09322    -.12121     -.66667
  400      44         45         67        1      .99177    -.32836     -.95652
  700      66         68         68        2      .00000     .00000      .00000
  300      54         69         69       15      .53452     .00000      .00000
  300      45         58         69       13      .85081    -.15942     -.45833
  600      73         79         76        6     1.11075     .03947     1.00000
  700      73         90         81       17      .83196     .11111     1.12500
  200      73         85         85       12      .44721     .00000      .00000
  900     112        128         86       16     1.31170     .48837    -1.61538
  600      85         87         87        2      .65465     .00000      .00000
  700      61        144         94       63     6.61577     .53191     3.84615
  900     101        113        104       12     1.17775     .08654     3.00000
  900     104        114        109       10     1.15492     .04587     1.00000
  200      77        182        112      105     1.97992     .62500     2.00000
  900     165        117        113      -48     1.12449     .03540     -.07692
  400     104        114        113       10      .75879     .00885      .11111
  900     119        129        128       10      .57248     .00781      .11111
  200      41         50        132        9     1.00379    -.62121     -.90110
  900     140         70        142      -70     2.53919    -.50704    10.00000
  600     114        130        143       16      .62877    -.09091     -.44826
  700     125        146        144       21      .66773     .01389      .10526
  600     137        152        164       15      .63246    -.07317     -.44444
  600     146        138        166       -8      .94024    -.16867    -1.40000
  300     163        161        169       -2     1.24035    -.04734    -1.33333
  200     163        179        181       16     1.08059    -.01105     -.11111
  600     191        218        190       27     5.02895     .14737    10.00000
  200     118        163        192       45     1.30411    -.15104     -.39189
  600     197        199        198        2     1.00358     .00505     1.00000
  600     217        218        214        1      .99689     .01869    -1.33333
  700     172        215        218       43      .14780    -.01376     -.06522
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QUICK QUERY     DAVE PORTCH     AD-30          MACRO QQP TEST OK                   MACRO.OK

SURVEY ORIGINAL   FORECAST   ACTUAL      FORECAST    U            STATISTIC    STATISTIC
       NUMBER     NUMBER     NUMBER      MINUS       STATISTIC    ONE          TWO
       EMPLOYEES  EMPLOYEES  EMPLOYEES   ORIGINAL

   700       80        108        218         28      .98538     -.50459      -.79710
   200      260        295        224         35     1.03453      .31696     -1.97222
   700      170        177        225          7      .86113     -.21333      -.87273
   900      200        212        226         12      .68258     -.06195      -.53846
   400      216        251        238         35      .93690      .05462       .59091
   900      207        257        245         50      .44906      .04898       .31579
     0      226        236        246         10      .92761     -.04065      -.50000
   900      241        265        248         24      .98592      .06855      2.42857
   900      237        241        248          4      .86092     -.02823      -.63636
   700      148        153        258          5      .95063     -.40698      -.95455
   900      265        287        282         22      .79278      .01773       .29412
   500      345        340        319         -5     1.00031      .06583      -.80769
   600      300        320        320         20     1.02072      .00000       .00000
   200      220        275        332         55      .57069     -.17169      -.50893
   900      342        379        337         37      .97368      .12463     -6.40000
   200      349        362        371         13      .93452     -.02426      -.40909
   200      272        299        371         27      .88310     -.19407      -.72727
   200      371        376        381          5      .76102     -.01312      -.50000
   200      359        378        405         19      .56010     -.06667      -.58696
   400      231        298        420         67      .78287     -.29048      -.64550
   200      350        579        460        229     2.55524      .25670      1.08182
   200      498        579        523         81     2.23217      .10707      2.24000
   400      416        467        628         51      .98157     -.25637      -.75943
   200      759        756        658         -3      .99978      .14894      -.97030
   300      679        685        660          6     1.02213      .03788     -1.31579
   200      475        550        750         75      .76410     -.26667      -.72727
   300      665        749        758         84      .24744     -.01187      -.09677
   200      956       1218        915        262     1.73378      .33115     -7.39024
   400     1167       1181       1250         14     1.00050     -.05520      -.83133
   600     1258       1396       1294        138     1.22226      .07883      2.83333
   900     1133       1234       1301        101      .55565     -.05150      -.39881
   600     1545       1554       1348          9      .99955      .15282     -1.04569
   200      237        228       1475         -9      .99857     -.84542     -1.00727
   900     1205       1370       1535        165      .56219     -.10749      -.50000
   700     1542       1558       1596         16      .90832     -.02381      -.70370
   700     1816       1912       1957         96     1.03085     -.02299      -.31915
   700     3115       3132       3108         17      .99872      .00772     -3.42857
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KENTUCKY

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QUICK QUERY     DAVE PORTCH    AD-30        MACRO QQP TEST OK          MACRO.OK

SURVEY ORIGINAL   FORECAST    ACTUAL      FORECAST    U           STATISTIC  STATISTIC
       NUMBER     NUMBER      NUMBER      MINUS       STATISTIC   ONE        TWO
       EMPLOYEES  EMPLOYEES   EMPLOYEES   ORIGINAL

   270        30          30           0          0    1.00000    10.00000   -1.00000
   393         1           1           1          0     .00000      .00000     .00000
   270         2           2           2          0     .00000      .00000     .00000
   201         2           2           2          0     .00000      .00000     .00000
   190        15          15           3          0    1.00000     4.00000   -1.00000
   270         2           2           3          0    1.00000     -.33333   -1.00000
   190         4           4           4          0     .00000      .00000     .00000
   230         4           4           4          0     .00000      .00000     .00000
   190         4           4           4          0     .00000      .00000     .00000
   206         2           2           4          0    1.00000     -.50000   -1.00000
   204         5           5           5          0     .00000      .00000     .00000
   190         3           3           5          0    1.00000     -.40000   -1.00000
   190         4           4           5          0    1.00000     -.20000   -1.00000
   190         5           5           5          0     .00000      .00000     .00000
   270         6           6           6          0     .00000      .00000     .00000
   204         7           7           6          0    1.00000      .16667   -1.00000
   240         6           6           6          0     .00000      .00000     .00000
   210         7           7           7          0     .00000      .00000     .00000
   190         8           8           7          0    1.00000      .14286   -1.00000
   285         6           6           7          0    1.00000     -.14286   -1.00000
   270         8           8           8          0     .00000      .00000     .00000
   324         8           8           8          0     .00000      .00000     .00000
   190         7           7           9          0    1.00000     -.22222   -1.00000
   190         8           8           9          0    1.00000     -.11111   -1.00000
   285        10          10          10          0    1.00000      .00000     .00000
   210        13          13          10          0    1.00000      .30000   -1.00000
   190        10          10          10          0     .00000      .00000     .00000
   202         5           5          10          0    1.00000     -.50000   -1.00000
   393        11          11          10          0    1.00000      .10000   -1.00000
   240         9           9          10          0    1.00000     -.10000   -1.00000
   190         4           4          10          0    1.00000     -.60000   -1.00000
   285        11          11          11          0    1.00000      .00000     .00000
   250        12          12          11          0    1.00000      .09091   -1.00000
   324        11          11          11          0     .00000      .00000     .00000
   324         9           9          13          0    1.00000     -.30769   -1.00000
   190        14          14          14          0     .00000      .00000     .00000
   284        15          15          14          0    1.00000      .07143   -1.00000
   240         5           5          14          0    1.00000     -.64286   -1.00000
   285        14          14          15          0    1.00000     -.06667   -1.00000
   324         7           7          15          0    1.00000     -.53333   -1.00000
   201        17          17          16          0    1.00000      .06250   -1.00000
   301        19          19          17          0    1.00000      .11765   -1.00000
   240        19          19          17          0    1.00000      .11765   -1.00000
   324        24          24          17          0    1.00000      .41176   -1.00000
   240        18          18          18          0     .00000      .00000     .00000
   270        22          22          18          0    1.00000      .22222   -1.00000
   210        19          19          18          0    1.00000      .05556   -1.00000
   190        20          20          18          0    1.00000      .11111   -1.00000
   190        20          20          19          0    1.00000      .05263   -1.00000
   190        20          20          20          0     .00000      .00000     .00000
   270        23          23          21          0    1.00000      .09524   -1.00000
   240        27          27          22          0    1.00000      .22727   -1.00000
```

```
QUICK QUERY     DAVE PORTCH    AD-30          MACRO QQP TEST OK             MACRO.OK

SURVEY ORIGINAL   FORECAST   ACTUAL     FORECAST    U             STATISTIC   STATISTIC
       NUMBER     NUMBER     NUMBER     MINUS       STATISTIC     ONE         TWO
       EMPLOYEES  EMPLOYEES  EMPLOYEES  ORIGINAL

   240        18         18         23          0    1.00000      -.21739    -1.00000
   270        24         24         24          0     .00000       .00000      .00000
   240        27         27         24          0    1.00000       .12500    -1.00000
   190        16         16         25          0    1.00000      -.36000    -1.00000
   202        26         26         26          0     .00000       .00000      .00000
   202        26         26         26          0     .00000       .00000      .00000
   190        16         16         27          0    1.00000      -.40741    -1.00000
   393        26         26         29          0    1.00000      -.10345    -1.00000
   208        27         27         30          0    1.00000      -.10000    -1.00000
   208        84         84         30          0    1.00000      1.80000    -1.00000
   270        26         26         33          0    1.00000      -.21212    -1.00000
   190        33         33         33          0     .00000       .00000      .00000
   250        30         30         35          0    1.00000      -.14286    -1.00000
   240        40         40         37          0    1.00000       .08108    -1.00000
   220        43         43         43          0     .00000       .00000      .00000
   190        60         60         44          0    1.00000       .36364    -1.00000
   240        45         45         46          0    1.00000      -.02174    -1.00000
   270        51         51         47          0    1.00000       .08511    -1.00000
   240        48         48         48          0     .00000       .00000      .00000
   270        55         55         48          0    1.00000       .14583    -1.00000
   270        46         46         50          0    1.00000      -.08000    -1.00000
   190        51         51         50          0    1.00000       .02000    -1.00000
   202        46         46         50          0    1.00000      -.08000    -1.00000
   250        51         51         51          0     .00000       .00000      .00000
   220        48         48         53          0    1.00000      -.09434    -1.00000
   393        45         45         55          0    1.00000      -.18182    -1.00000
   208        61         61         57          0    1.00000       .07018    -1.00000
   204        68         68         58          0    1.00000       .17241    -1.00000
   190        54         54         59          0    1.00000      -.08475    -1.00000
   202        61         61         59          0    1.00000       .03390    -1.00000
   270        60         60         60          0     .00000       .00000      .00000
   190        62         62         61          0    1.00000       .01639    -1.00000
   270        69         69         66          0    1.00000       .04545    -1.00000
   264        69         69         67          0    1.00000       .02985    -1.00000
   202        74         74         74          0     .00000       .00000      .00000
   285        72         72         74          0    1.00000      -.02703    -1.00000
   301        74         74         76          0    1.00000      -.02632    -1.00000
   190        56         56         77          0    1.00000      -.27273    -1.00000
   208        83         63         79          0    1.00000       .05063    -1.00000
   190        58         58         91          0    1.00000      -.36264    -1.00000
   230        98         98         94          0    1.00000       .04255    -1.00000
   321        91         91         95          0    1.00000      -.04211    -1.00000
   324        96         96         96          0    1.00000       .00000      .00000
   270       101        101         98          0    1.00000       .03061    -1.00000
   335        85         85        100          0    1.00000      -.15000    -1.00000
   204       106        106        105          0    1.00000       .00952    -1.00000
   190        85         85        111          0    1.00000      -.23423    -1.00000
   290       116        116        115          0    1.00000       .00870    -1.00000
   250       147        147        117          0    1.00000       .25641    -1.00000
   190       100        100        122          0    1.00000      -.18033    -1.00000
   250       195        195        128          0    1.00000       .52344    -1.00000
   282       100        100        134          0    1.00000      -.25373    -1.00000
```

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QUICK QUERY    DAVE PORTCH    AD-30        MACRO QQP TEST OK          MACRO,OK

SURVEY ORIGINAL   FORECAST    ACTUAL      FORECAST  U            STATISTIC  STATISTIC
       NUMBER     NUMBER      NUMBER      MINUS     STATISTIC    ONE        TWO
       EMPLOYEES  EMPLOYEES   EMPLOYEES   ORIGINAL

   208       118        118         146          0     1.00000    -.19178   -1.00000
   201       155        155         152          0     1.00000     .01974   -1.00000
   190       168        168         154          0     1.00000     .09091   -1.00000
   264       164        164         161          0     1.00000     .01863   -1.00000
   190       151        151         165          0     1.00000    -.08485   -1.00000
   204       166        166         182          0     1.00000    -.08791   -1.00000
   190       186        186         184          0     1.00000     .01087   -1.00000
   250       172        172         189          0     1.00000    -.08995   -1.00000
   190       190        190         197          0     1.00000    -.03553   -1.00000
   190       167        167         198          0     1.00000    -.15657   -1.00000
   264       185        185         199          0     1.00000    -.07035   -1.00000
   270       199        199         199          0      .00000     .00000     .00000
   205       200        200         203          0     1.00000    -.01478   -1.00000
   335       223        223         204          0     1.00000     .09314   -1.00000
   190       220        220         231          0     1.00000    -.04762   -1.00000
   230       250        250         250          0     1.00000     .00000     .00000
   190       246        246         263          0     1.00000    -.06464   -1.00000
   313       199        199         278          0     1.00000    -.28417   -1.00000
   190       309        309         280          0     1.00000     .10357   -1.00000
   230       417        417         282          0     1.00000     .47872   -1.00000
   270       325        325         309          0     1.00000     .05178   -1.00000
   190       340        340         361          0     1.00000    -.05817   -1.00000
   250       367        367         367          0      .00000     .00000     .00000
   208       390        390         406          0     1.00000    -.03941   -1.00000
   250       438        438         420          0     1.00000     .04286   -1.00000
   190       406        406         427          0     1.00000    -.04918   -1.00000
   208       409        409         451          0     1.00000    -.09313   -1.00000
   282       483        483         464          0     1.00000     .04095   -1.00000
   332       373        373         465          0     1.00000    -.19785   -1.00000
   190       454        454         478          0     1.00000    -.05021   -1.00000
   220       445        445         480          0     1.00000    -.07292   -1.00000
   190       492        492         494          0     1.00000    -.00405   -1.00000
   230       372        372         520          0     1.00000    -.28462   -1.00000
   190      1017       1017         525          0     1.00000     .93714   -1.00000
   240       582        582         581          0     1.00000     .00172   -1.00000
   335       543        543         583          0     1.00000    -.06861   -1.00000
   208       652        652         625          0     1.00000     .04320   -1.00000
   331       764        764         777          0     1.00000    -.01673   -1.00000
   201       787        787         820          0     1.00000    -.04024   -1.00000
   190      1005       1005        1013          0     1.00000    -.00790   -1.00000
   230       998        998        1072          0     1.00000    -.06903   -1.00000
   230       693        693        1099          0     1.00000    -.36943   -1.00000
   282      1119       1119        1159          0     1.00000    -.03451   -1.00000
   270      1314       1314        1207          0     1.00000     .02865   -1.00000
   282      1446       1446        1354          0     1.00000     .06795   -1.00000
   190      3293       3293        3293          0      .00000     .00000     .00000
   190       150        165           0         15     1.09656   10.00000   -1.10000
   240        97        119           0         22     1.19470   10.00000   -1.22680
   250         5          6           2          1     1.09545    2.00000   -1.33333
   284         3          5           3          2     1.00000     .66667   10.00000
   307         3          4           4          1      .00000     .00000     .00000
   240         4         30           4         26     1.00000    6.50000   10.00000
```

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QUICK QUERY    DAVE PONTCH    AD-30        MACRO QQP TEST OK          MACRO.OK

SURVEY ORIGINAL   FORECAST    ACTUAL      FORECAST   U            STATISTIC  STATISTIC
       NUMBER     NUMBER      NUMBER      MINUS      STATISTIC    ONE        TWO
       EMPLOYEES  EMPLOYEES   EMPLOYEES   ORIGINAL

  285          2          3          4          1    1.22474    -.25000     -.50000
  202          7          8          7          1    1.22474     .14286    10.00000
  250          4          3          7         -1    1.33333    -.57143    -1.33333
  190          7          8          7          1    1.00000     .14286    10.00000
  270          8          9          7          1    1.41421     .26571    -2.00000
  190          7          9          7          2    1.00000     .28571    10.00000
  307         14         19          8          5    1.44914    1.37500    -1.83333
  190         14         18          9          4    1.55299    1.00000    -1.80000
  190          8          8         10          0     .70711    -.20000    -1.00000
  324          9         15         10          6    1.00000     .50000     5.00000
  311         10          9         10         -1    1.00000    -.10000    10.00000
  190         10         11         11          1     .00000     .00000      .00000
  324         16         17         12          1     .98058     .41667    -1.25000
  230         12         16         12          4    1.00000     .33333    10.00000
  204         12         15         13          3    2.00000     .15365     2.00000
  190         12         20         13          8    3.31662     .53846     7.00000
  190         12         18         13          6    2.14476     .38462     5.00000
  230         12         15         14          3     .91267     .07143      .50000
  204         14         15         15          1    1.41421     .00000      .00000
  190         17         19         15          2    1.73205     .26667    -2.00000
  190         14         24         15         10    1.33012     .60000     9.00000
  230         15         19         15          4    1.00000     .26667    10.00000
  307         16         19         16          3    1.00000     .18750    10.00000
  270         12         15         16          3    1.17260    -.06250     -.25000
  190         17         25         16          8    3.67298     .56250    -9.00000
  240         15         16         17          1    1.06672    -.05882     -.50000
  240         20         19         18         -1    1.22474     .05556     -.50000
  270         18         21         18          3    1.35401     .16667    10.00000
  190         19         23         19          4    1.00000     .21053    10.00000
  190         18         29         20         11    3.24037     .45000     4.50000
  281         20         26         21          6    1.29316     .23810     5.00000
  250         16         19         22          3     .92195    -.13636     -.50000
  190         20         23         24          3    1.02247    -.04167     -.25000
  204         26         31         24          5    2.17945     .29167    -3.50000
  307         25         28         26          3    2.44949     .07692     2.00000
  190         27         29         26          2    2.64575     .11538    -3.00000
  208         27         29         26          2    1.05131     .11538    -3.00000
  324         16         21         26          5    1.02661    -.19231     -.50000
  190         22         24         28          2    1.16316    -.14286     -.66667
  324         28         33         33          5     .47140     .00000      .00000
  190         37         43         37          6    1.00000     .16216    10.00000
  335         39         45         40          6    1.31149     .12500     5.00000
  240         52         58         42          6    1.25357     .30095    -1.60000
  332         27         29         42          2     .90992    -.30952     -.86667
  307         42         48         42          6    1.00000     .14286    10.00000
  324         33         43         43         10     .00000     .00000      .00000
  230         35         44         45          9     .53321    -.02222     -.10000
  328         48         61         46         13    1.30000     .32609    -7.50000
  208         13         50         46         37     .53182     .08696      .12121
  202         44         46         47          2     .65465    -.02128     -.33333
  270         35         37         50          2    1.00000    -.26000     -.36667
  240         52         68         51         16    7.68115     .33333    10.00000
```

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QUICK QUERY     DAVE PURTCH     AD-30          MACRO QQP TEST OK                   MACRO.OK

SURVEY ORIGINAL   FORECAST   ACTUAL     FORECAST    U          STATISTIC  STATISTIC
       NUMBER     NUMBER     NUMBER     MINUS       STATISTIC  ONE        TWO
       EMPLOYEES  EMPLOYEES  EMPLOYEES  ORIGINAL

  190       42         45         52          3       .97118    -.13462     -.70000
  210       54         56         52          2      1.22474     .07692   -2.00000
  190       50         59         56          9       .75455     .05357     .50000
  250       55         63         57          8      1.00000     .10526    3.00000
  393       54         58         59          4      1.01533    -.01695     -.20000
  230       39         41         60          2      1.00000    -.31667     -.90476
  201       58         61         60          3      1.87083     .01667     .50000
  264       47         53         62          6      1.02273    -.14516     -.60000
  270       70         71         63          1       .99396     .12698   -1.14286
  203       64         67         65          3      1.41421     .03077    2.00000
  190       50         65         67         15      1.12687    -.02985     -.11765
  307       56         76         68         20       .87287     .11765     .66667
  201       74         77         73          3      1.15470     .05479   -4.00000
  307       70         76         76          6      1.78377     .00000     .00000
  190       63         85         78         22       .62017     .08974     .46667
  240       85         90         81          5      1.47196     .11111   -2.25000
  240       88        114         82         26      1.60688     .39024   -5.33333
  240       81         92         90         11      1.06271     .02222     .22222
  190       90        147         91         57      5.40135     .61538   10.00000
  335       94        120         93         26      9.32738     .29032   10.00000
  190      109        110         96          1      1.00456     .14583   -1.07692
  190       99        124         98         25     11.74734     .26531   10.00000
  307      128        147        101         19      1.35300     .45545   -1.70370
  285      100        111        103         11      1.02353     .07767    2.66667
  332       93        106        103         13      1.11803     .02913     .10000
  210      482        483        108          1      1.00033    3.47222   -1.00267
  208      104        109        110          5       .69085    -.00909     -.16667
  190      108        149        112         41      2.41128     .33036    9.25000
  190      103        109        113          6      1.14812    -.03540     -.40000
  311      107        114        114          7       .23905     .00000     .00000
  270      108        127        115         19      1.55741     .10435    1.71429
  190      115        129        116         14      1.36277     .11207   10.00000
  190      113        122        118          9      1.02421     .03390     .80000
  203      118        132        118         14      1.87083     .11864   10.00000
  270      115        118        118          3      1.19523     .00000     .00000
  190      154        168        122         14      1.05529     .37705   -1.43750
  190      165        176        124         11       .95818     .41935   -1.26829
  190      159        145        125        -14       .76649     .16000     -.58824
  ?08      128        129        128          1      1.00000     .00781   10.00000
  208      169        173        138          4       .77162     .25362   -1.12903
  190        4        221        140        217       .82631     .57857     .59559
  264      141        151        140         10      2.23607     .07857   10.00000
  270      122        137        145         15      1.06208    -.05517     -.34783
  230      152        155        157          3      1.09545    -.01274     -.40000
  204      160        159        162         -1       .99960    -.01852   -1.50000
  190      174        177        178          3      1.01460    -.00562     -.25000
  190      202        219        189         17      1.34778     .15873   -2.30769
  202      127        142        194         15       .72237    -.26804     -.77612
  190      185        261        195         76      5.63165     .33846    6.60000
  190      169        192        195         23       .34605    -.01538     -.11538
  190      216        228        201         12      1.25525     .13433   -1.80000
  264      187        193        203          6       .92973    -.04926     -.62500
```

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QUICK QUERY     DAVE PORTCH    AD-30         MACRO QQP TEST OK           MACRO.OK

SURVEY ORIGINAL   FORECAST   ACTUAL      FORECAST    U           STATISTIC   STATISTIC
       NUMBER     NUMBER     NUMBER      MINUS       STATISTIC   ONE         TWO
       EMPLOYEES  EMPLOYEES  EMPLOYEES   ORIGINAL

  250       230        251         209          21      1.10972     .20096   -2.00000
  190       193        212         236          19       .77339    -.10169    -.55814
  230       249        282         243          33      2.08033     .16049   -6.50000
  282       206        228         256          22       .94691    -.10938    -.56000
  190       255        262         256           7       .95929     .02344    6.00000
  230       228        233         258           5       .80913    -.09690    -.83333
  264       243        242         261          -1      1.00673    -.07280   -1.05556
  190       250        277         266          27      1.10507     .04135     .66750
  331       233        254         267          21       .80127    -.04869    -.38235
  282       182        190         268           8       .99134    -.29104    -.90698
  230       314        328         274          14      1.10748     .19708   -1.35000
  190       221        372         276         151      1.81363     .35273    1.79630
  203       354        436         292          82      1.86895     .49315   -2.32258
  190       267        268         293           1      1.00105    -.08532    -.96154
  190       407        461         300          54      1.13611     .53667   -1.50467
  281       270        272         302           2      1.00000    -.09934    -.93750
  190       246        300         313          54      1.07340    -.04153    -.19403
  190       304        318         325          14      1.22089    -.02154    -.33333
  307       324        353         329          29      1.96566     .07295    4.60000
  190       315        324         336           9       .80721    -.03571    -.57143
  190       354        370         361          16       .91784     .02493    1.28571
  190       292        313         365          21       .94466    -.14247    -.71233
  307       364        403         370          39      1.09065     .08919    5.50000
  190       459        459         429           0      1.00110     .06993   -1.00000
  208       430        418         430         -12      2.06155    -.02791   10.00000
  264       430        455         433          25      1.10378     .05081    7.33333
  220       483        535         492          52      1.22870     .21041   -2.26829
  190       419        526         481         107      1.09294     .09356     .72581
  331       527        413         530        -114      6.04469    -.22075   10.00000
  208       578        520         535         -58       .95129    -.02804     .34884
  190       643        701         679          58       .95971     .03240     .61111
  230       741        777         714          36      1.17354     .08824   -2.33333
  190       755        775         763          20      1.02036     .01573    1.50000
  190       771        802         788          31      1.02793     .01777     .82353
  220       635        699         811          64       .98889    -.13810    -.63636
  230       847        848         826           1      1.00023     .02663   -1.04762
  190       849        850        1101           1       .99967    -.22797    -.99603
  190       997       1064        1164          67       .89533    -.08591    -.59880
  190      1296       1301        1309           5      1.00123    -.00611    -.61538
  210      3134       3274        3439         140       .86172    -.04798    -.54098
  331      4552       4562        4469          10      1.00959     .02081   -1.12048
```

APPENDIX I

OTIS SUPPLY ADJUSTMENT PROCEDURES

OTIS SUPPLY ADJUSTMENT PROCEDURES

There are five primary sources of manpower supply data used in this report, i.e., the Oklahoma State Department of Vocational and Technical Education, the Governor's Comprehensive Manpower Planning Staff, the State Accrediting Agency, the Oklahoma Employment Security Commission, and the Oklahoma Board of Nurse Registration and Nurse Education.

The Oklahoma State Department of Vocational and Technical Education provides information on four categories of manpower supply, i.e., high school vocational program graduates, post high school vocational program graduates, adult vocational program graduates, and Manpower Development Training Act (MDTA) graduates.

The figures entered into the tables in Chapter II for secondary and post-secondary vocational and technical students are calculated in the following manner. The first phase of the problem was to find the percentage of the 1971-1972 students who have dropped out or completed each of the vocational programs and to find out how many are available for job placement. This was done by searching the student accounting system for:

- Those who dropped out of school and are employed full time in the field for which they were trained (VE-6000-R-1, Code 6)
- The number of students who are unknown (VE-6000-R-2, Code 9)
- Those who are not available for placement (VE-6000-R-2, Code 0, 1, 2, and 3)
- Those who are available for placement (VE-6000-R-2, Code 4, 5, 6, 7, and 8)
- The total number with completion response (VE-6000-R-1, Code 1 through 8)
- The total number enrolled in the program (VE-6000-R) for each occupational objective

The percentage of students who dropped out of school and are employed full time in the field for which they are trained or completed the program and were available for the labor market were calculated by:

$$PC = \frac{a + d}{a + d + b + c} \times \frac{f}{e}$$

If there was insufficient information to calculate the percentage, the percentage was based upon OTIS Cycle Three Report, Supplement Five, "A Follow-Up Study of Oklahoma Vocational and Technical Education Graduates and Drop-outs; 1968-1969 and 1969-1970," August 31, 1972.

The second phase was to calculate the number of students available for the labor market by accumulating the number of students who completed the program (VE-6000-R-1, Code 1) from the 1971-1972 student accounting system and multiplying it by the percentage worked out above for each occupational objective.

Secondary programs, other than reimbursed vocational-technical programs, provide input into the labor market. Information on what happens to these graduates is not available. Research that is in progress should provide information so that supply data from this can be included in future OTIS reports.

The figures entered into the tables in Chapter II for adults are calculated by searching the student accounting system and other available records for:

- The number of adult preparatory students
- The number of adult supplementary students in adult classes for each occupational objective

The formula used to calculate percentage available for the labor market was:

$$PC = \frac{g}{g + h} \times .86 \times \frac{(\text{VE-6000-R-2, Code 4, 5, 6, 7, 8})}{(\text{VE-6000-R-1, Code 1})}$$

The factor .86 was used to eliminate duplicated enrollment. The adult enrollment for 1971-1972 was used to calculate the figures in the table in Chapter II.

One hundred percent of the graduates in the MDTA programs are listed as available to the labor market.

The Governor's Comprehensive Manpower Planning Staff provides data on the number of graduates to be produced by the federal training programs not associated with the State Department of Vocational and Technical Education.

Data on private school graduates were obtained from the license application required annually by House Bill 1403. This licensing procedure is supervised by the State Accrediting Agency.

The Oklahoma Employment Security Commission provides the number of qualified registrants who are available to fill jobs listed in the OTIS Report.

The Oklahoma Board of Nurse Registration and Nurse Education and the Oklahoma State Department of Vocational and Technical Education provide data on the number of nurses that are available for the labor market.

APPENDIX J

BLS EMPLOYMENT DATA COLLECTION AND FORECASTING PROGRAMS

I. INTRODUCTION

This appendix presents a summary of three employment data collection and forecasting programs conducted by the Bureau of Labor Statistics (BLS) of the Department of Labor. These programs are the:

- National/State Industry-Occupation Matrix (matrix) Program
- Tomorrow's Manpower Needs (TMN) Program
- Occupational Employment Statistics (OES) Program

Essentially, these programs are federal/state data collection and analysis efforts. Collectively, their purpose is to gather information to meet federal, state, and local manpower information needs.

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II. NATIONAL/STATE INDUSTRY-OCCUPATION MATRIX PROGRAM

The National/State Industry-Occupation Matrix Program provides the occupational composition of the labor force in the state by industry for 1970. In addition, a multipurpose computer system is provided for utilization of the matrix and other information to update and project state and regional matrices. Currently, the base year of the matrix is the census year so that detailed information gathered in the decennial census can be utilized in developing the matrix. For example, the occupational composition of the labor force in particular industries is reported in the U. S. Census Bureau publication Occupation By Industry.

The industry-occupation matrices present occupational profiles covering approximately 425 occupations in approximately 200 industries which represent all types of economic activity. Also, the matrix provides data that can be used as a basis for projecting future manpower requirements. Specifically, the tables display changes in the composition of the labor force over time. In turn, employment levels for a particular year may be predicted by industry and occupational category. Subsequently, the occupational totals in each industry can be summed to project the manpower requirements by occupation for the entire economy.

This section details the procedures employed by BLS to develop a base period matrix. Additionally, the methods utilized to predict occupational patterns and project industry employment are explained in detail.

1. THE DEVELOPMENT OF THE BASE PERIOD MATRIX IS BASED ON INDUSTRY AND OCCUPATIONAL EMPLOYMENT DATA

Development of the base period matrix requires:

- Data depicting total employment by industry and the occupational composition of industries
- Annual employment data. This information facilitates the examination of changes in occupational patterns by industry and an analysis of these changes in relation to external factors such as changes in technology.

A variety of sources provide these requisite data. Principal sources are described below.

(1) Two Data Collection Programs Provide Information On Industry Employment

Two ongoing data collection programs provide information which is used to develop estimates of the total employment in the U.S. and in each matrix industry. Specifically, these programs are:

- Current Population Survey (CPS) Program--Data collected each month through a nationwide sample of 52,500 households are recognized as the authoritative basis for estimating total employment in the U.S. All classes of workers are sampled, including self-employed and unpaid family workers as well as wage and salary workers. The monthly estimates for a year are averaged to provide the estimate of total employment presented in the Industry-Occupation Matrix.

- Current Employment Statistics (CES) Program--Data collected monthly and annually from a sample of approximately 160,000 employees provide detailed industry estimates for private wage and salary workers who comprise the majority of the labor force.

The data collected through the CES are augmented by information from the following sources.

- Survey Of Governments
- Unemployment Insurance Statistics
- U.S. Civil Service Commission
- Population Census

Data collected through the CES and other sources facilitate estimating total employment by industry. The estimates for the industries are manipulated to agree with the estimate of total employment derived from the CPS. Hence, a link is established between the BLS wage and salary worker statistics and the total employment statistics derived from the population survey.

(2) Two Methods Are Used To Estimate Occupational Employment By Industry

The decennial census provides the information used to distribute total U.S. employment among occupations and industries. Nonetheless, several factors limit the use of census data in compiling occupational employment information for the matrix.

- Census data are compiled every 10 years; thus, the use of these data for trend analyses is limited.
- Census data differ from the CPS data used to project total U.S. employment and from CES data used to estimate detailed industry employment.
- Occupational information for the entire labor force may not be available from the census due to non-responses and undercounting.

Therefore, other reliable sources which provide data more frequently are used to estimate occupational employment. These sources include:

- BLS employer surveys for scientists and engineers
- Office of Education data on the employment of teachers and librarians
- Regulatory agency data on the occupational composition of interstate industries, e.g., railroads, airlines, telephone and telegraph companies, and pipeline companies
- Professional society data for medical and health occupations
- U.S. Postal Service occupational employment information
- Federal Civil Service Commission statistics on employment by occupation in Federal government agencies

A second method of collecting occupational data is used for occupations for which employment data are not available annually or periodically. The population census Industry By Occupation tables are used for estimating employment in these occupations. However, the tables must be adjusted to allow for undercounting and other differences with data from preferred sources. In particular, adjustments involve forcing census estimates alternately to industry employment totals and occupational group totals. This iterative manipulation is repeated until each matrix cell is consistent with both sets of marginal controls.

(3) The Industry And Occupational Employment Data Are Combined To Produce The Base Period Matrix

The industry and occupational data gathered through the processes described above are used to produce a matrix. This matrix displays the ratio of the employment for each occupation in the industry to the total employment in the industry. These ratios are used in conjunction with detailed industry employment information to provide meaningful data for estimating future manpower requirements.

2. OCCUPATIONAL EMPLOYMENT PROJECTIONS ARE DEVELOPED USING ESTIMATES OF INDUSTRY EMPLOYMENT AND OCCUPATIONAL STAFFING PATTERNS

BLS utilizes the Industry-Occupational Matrix to project future manpower requirements. These projections are based on a series of predictions about the economy in the projection year, e.g., the estimated real Gross National Product (GNP) and the unemployment rate for the target year. Given these predictions, two steps are followed to project future labor demand by occupation.

- Total manpower requirements in each detailed industry are projected.
- Trends in the proportion of each occupation in each industry are analyzed and staffing patterns (ratios) for the target year are developed.

(1) Three Methods Of Analysis Are Used To Project Industry Employment

The first step in the development of projections for industry employment is to estimate the level of real GNP. Once real GNP has been estimated, total employment is distributed by industry in several ways. The actual distribution depends on the data available, the level of industry detail required, and the characteristics of the industry.

Three different methods of analysis are used to project industry requirements.

- Input/Output Analysis is used to translate GNP into industry employment requirements. In this method, GNP is distributed to the final demand sectors. The output of each industry is determined through input/output relations which show the value added to output in the industry of final demand. Productivity in each industry is projected to derive the labor required per unit of output. Together, total output and labor required per unit determine labor requirements by industry.

- Regression Analysis also is used to estimate employment in each industry. Employment is projected through a system of equations which relate total employment in each industry to significant variables or model assumptions, e.g., GNP, population, and unemployment rate.

- Analysis Of Key Factors which are expected to influence the growth of individual industries is conducted. This approach is utilized when past trends in employment are not expected to be indicative of future trends or when other methods of analysis provide unacceptable results. A variety of regression equations are developed and tested. The equations providing the best statistical results are used to project employment.

The detailed industry employment projections resulting from these analytical approaches are compared and evaluated to arrive at the best approximation of projected industry employment. Similar to the base period matrix development approach, the totals for the industry projections are forced to agree with the assumed level of total employment in the target year.

(2) Data From Many Sources Are Analyzed To Project Industry Occupational Structure

The occupational composition of the work forces in particular industries are projected after careful analysis of historical occupational composition data. Data on occupational employment in each industry are obtained from the population census. As noted earlier, these data are supplemented with data from the following sources:

- U.S. Postal Service data on employment by occupation

- Regulatory agency data on the occupational composition of certain interstate industries

- Federal Civil Service Commission statistics on employment by occupation in Federal government agencies

- Office of Education data on the employment of teachers and librarians

- Public Health Service data on the medical and health occupations

- BLS employer surveys for scientists and engineers

Initially, historical patterns of changes in an industry's occupational composition are projected to the target year by the use of trend lines. The trend for each occupational ratio, whether projected from census data or other sources, is extended to the target year. The difference of the ratio in the base year of the matrix and the ratio in the target year is added to the ratio in the base period Industry-Occupational Matrix. In result, a first approximation of industry occupational structure in the target year is produced.

Occupational trend data are analyzed further to identify factors which caused past changes in the occupational structure. Subsequently, the probable impacts of these factors on occupational employment are estimated for the target year. Occupational ratios for the target year are adjusted, based on the impact of these factors and of emerging factors not reflected in the historical statistics. The resulting ratios depict the projected occupational composition of particular industries in the target year.

(3) Estimated Occupational Ratios Are Used In Conjunction With Projected Industry Employment To Forecast Future Manpower Requirements

The final step in the projection process involves applying the occupational ratios to the detailed industry employment projections. The figures produced by this comparison represent an estimate of the occupational requirements by industry for the target year. Data for the individual occupations may be summed across industries to provide estimates of total occupational demand. Further, other industry employment projections based on different assumptions may be developed because the occupational ratios are developed independently of industry employment data. When the occupational ratios are applied to these industry employment projections, occupational requirements by industry may be identified for varying economic conditions.

III. TMN PROGRAM

During the past several years, BLS has developed information on current and projected state and local occupational manpower requirements while continuing to compile and analyze national manpower information. BLS published a four-volume bulletin called "Tomorrow's Manpower Needs," in 1969. This bulletin contained national occupational and industrial employment data and provided techniques for projecting occupational manpower requirements at the state and local level. More importantly, the projection techniques formed the core of the TMN Program. Program principles include:

- Local projections should be developed within the context of national economic and industrial trends.
- Mechanically produced projections should be reviewed by knowledgeable local analysts.
- Projections which are consistent with other factors affecting the future of the area should be developed systematically.
- The projection techniques utilized must ensure flexibility and program continuity. The techniques adopted for the program involve application of National/State Industry-Occupation Matrix patterns to estimate the occupational composition of industrial employment in the state for base and target years. Results are summed to occupational totals and a change factor for each occupation is calculated. These change factors are then applied to estimates of base period occupational employment to yield projections of occupational requirements.

IV. OES PROGRAM

Three BLS programs were merged under the heading of the OES program in May, 1973. The three component programs were:

- The OES Survey
- The National/State Industry-Occupation Matrix System
- The State And Area Occupational Manpower Projections Program

The resulting OES program is a national/state cooperative venture involving BLS, the Manpower Administration, and state employment security agencies. The program is designed to respond to the increasing number of requests for reliable information on current and projected occupational employment at the state and local levels.

1. THE OES SURVEY

In 1970, BLS, the Manpower Administration, and a number of state employment security agencies joined to initiate the OES survey. This mail survey program is designed to produce estimates of occupational employment by industry for the entire nonagricultural wage and salary labor force. While the immediate goal of the program focuses on producing occupational employment estimates for states and subdivisions of states, ultimately, the program also will produce national level estimates.

Currently, 26 states are participating in this pilot project. The survey provides for the collection of sample data on occupational employment patterns of industries. These data, after expansion to represent the population of industries, provide meaningful and useful estimates on the occupational composition of of the labor force.

(1) The OES Survey Satisfies Five Information Needs

Prior to development of the OES survey, many other programs collected data on the current occupational composition of industries. These programs included the Census of the Population, Current Population Survey, Industry Wage Survey, and Area Skill Survey. Information compiled by these programs was fragmented and inadequate to meet the needs of manpower planners and other data users. Therefore, the OES survey was designed to achieve the following objectives:

- Develop occupational employment estimates by industry. These estimates will provide the basis for producing a time series of estimates of employment by occupation.
- Provide data about the occupational composition of industries, including:
    - Differences in occupational composition within an industry by size of establishment, process, etc.
    - Extent of inter-establishment variability
    - Changes in occupational composition in response to external factors such as changing technology
- Provide occupational information in a form that permits development and improvement of industry-occupational matrices at the state and area levels and, ultimately, at the national level

(2) The OES Survey Collects Occupational Data

The OES survey collects data from a sample of employers on the occupational composition of industries within each of the cooperating states. The state employment security agencies analyze and edit the data and produce occupational employment estimates by industry.

Specifically, occupational employment data are collected from industries through mail questionnaires. The OES survey is designed to cover all nonagricultural wage and salary employment. Selected establishments receive questionnaires through the mail and are asked to provide information on the occupational composition of the labor force within their establishments as of a specified date. The date is chosen to provide data from a typical month in terms of employment seasonability. Data are collected for pre-listed and employer listed occupations. Only pre-listed occupations are used from the first round of sampling.

The survey of manufacturing industries conducted during 1972 utilized 33 separate questionnaires to collect occupational employment data at the three-digit Standard Industrial Classification (SIC) level. On each questionnaire, a list of approximately 80 occupations that are common to many different manufacturing industries was provided. In addition to the standard list, each questionnaire included a second list of other occupations that are important to the particular industry. Importance was determined by the number of employees in these occupations. Additionally, other occupations requiring a substantial period of education or training were listed for selected industries.

Employers receiving questionnaires are requested to provide the following information for the designated reference date:

- Total number of workers employed in the listed occupations
- Total number of apprentices in specifically designated occupations
- Total number of workers engaged primarily in research and development activities for specific scientific and technical occupations

BLS personnel validate the data supplied by employers for completeness and reasonableness after occupational employment estimates are generated.

(3) Data Collected From The Employer Sample Is Used To Produce Occupational Employment Estimates By Industry

Occupational employment estimates are prepared for each industry size class, e.g., 500-999 employees, on an industry-by-industry basis. The occupational estimates for each size class are developed at the most detailed SIC level permitted by the sample. These estimates are relatively detailed because occupational employment patterns are generally most similar among establishments which are of the same size and engaged in manufacturing similar products or performing similar services.

The process used to derive occupational employment estimates from the sample data involves four basic steps:

- The reported occupational employment figure for an establishment is multiplied by the establishment's sample weight.

- The weighted occupational employment figure for the establishment is summed with similar data for all other sample establishments in the same industry size class (cell).

- The sum of the weighted occupational employment data is divided by the sum of the weighted total employment for all reporting establishments in the cell. This produces the occupational ratio for the cell.

- The ratio is multiplied by the total industry employment figure for the cell, as determined from ES 202 data, to yield the estimated number of workers in each occupation in the cell.

This process can be expressed by the formula below.

$$P_c = \left(\frac{\Sigma p_i \ w_i}{\Sigma e_i \ w_i}\right) M$$

where:

P_c = Estimate for occupation P in an industry size cell

p_i = Reported employment for occupation P by number of establishments in an industry size cell

M = The ES 202 benchmark employment for the industry size cell

e_i = Reported total employment in the ith establishment in an industry size cell

w_i = The reciprocal of the sample weight or the sampling ratio of the ith establishment in an industry size cell

The occupational estimates produced for each cell can be aggregated at various levels to produce data on the occupational composition of different levels of industry detail, e.g., three-digit or two-digit SIC code industries. These estimates provide valuable state and local level information heretofore unavailable from a single data source. Specifically, occupational employment estimates for states and state subdivisions can be used to construct state and local level industry-occupational matrices for all wage and salary employment classifications. These matrices, in turn, may provide the basis for projecting occupational employment requirements.

2. THE NATIONAL/STATE INDUSTRY-OCCUPATION MATRIX SYSTEM

Early in 1972, BLS inaugurated a new program called the National/State Industry-Occupation Matrix System. This system was developed with the cooperation of the Manpower Administration and state employment security agencies. The purpose of the system is to develop occupational information at the state and local levels.

The system is designed to provide a set of 51 (all states and the District of Columbia) individual matrices consistent in format, concept, and data base with the BLS national matrix. A matrix will be developed for each state and the District of Columbia. The data base for the program is a special tabulation of industry by occupation by class of worker from the 1970 census for each state. The system also includes preparation of occupation-specific death and retirement rates for each state that can be used to help estimate total occupational demand. These rates were developed using special census tabulations of occupational employment distributed by age and the BLS standard working life tables.

The first goal of the system is to provide an employment matrix for each state which covers over 400 occupations and 200 industries and can be used to generate projections of occupational requirements with greater accuracy than projections based on national patterns alone. Another goal is to provide a flexible, multipurpose computer system that will allow a state to update its matrix, e.g., supplement the census-based matrix with data from the OES survey and prepare sub-state estimates.

Currently, a number of states are nearing completion of the design phase, including preparation of the new 1970 national matrix and development and documentation of the computer software package. Most state agencies have reviewed the basic census input data and prepared special industrial employment controls covering 200 industrial sectors and six classes of worker categories. Plans call for implementation of the system to begin in early 1975.

3. THE STATE AND AREA OCCUPATIONAL MANPOWER PROJECTIONS PROGRAM

Effective November, 1972, BLS was charged with the responsibilities for providing consultation and technical assistance to state employment security agencies concerning state and area occupational manpower projections. This assistance program requires:

- Continuous research efforts to develop and improve methods of preparing state and local manpower projections
- Development and maintenance of technical manuals, guidelines, and other appropriate materials presenting projection procedures to the state agencies
- Centralized processing by state agencies of state data related to the development of occupational demand projections

4. INTERIM MANPOWER PROJECTION PROGRAM

Projections based on the state matrix program cannot be available in time for Fiscal Year 1975 planning. Therefore, the Bureau has recently undertaken an interim project to develop state and sub-state projections for the FY 1975 manpower planning cycle.

This project is being conducted in conjunction with the Manpower Administration. Specifically, BLS is responsible for developing and coordinating technical aspects of the program, while state employment agencies are responsible for organizing data files and determining and disseminating the occupational projections. A centralized data processing capability is being funded by the Manpower Administration.

During the first phase of the project, BLS will research and test various procedures for developing sub-state area projections and pilot test the project in one or more local labor market areas. State projections for some 400 occupations will be developed using a modified TMN methodology. These projections are scheduled for completion in mid-October, while projections for smaller geographic areas were completed in December, 1973. Efforts were made to maximize the level of detail of both occupational and geographic data, according to the constraints of available data and projection reliability.